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Modeling of the seepage flux of ground water from coastal landfills.

Colden, Damian A.

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MODELING OF THE

SEEPAGE FLUX OF GROUND WATER

FROM COASTAL LANDFILLS

BY

DAMIAN A. COLDEN

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE

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OF

DAMIAN A. COLDEN

ABSTRACT

The ability to predict seepage rates and locations of seepage flux from a sanitary landfill is paramount in evaluating the environmental impact a landfill may have. This ability extends to investigations relevant to the remediation of closed or abandoned waste sites, many of which contain hazardous materials. This is of particular importance in the evaluation of a coastal landfill.

Hydrogeologic characterization of landfills has relied on conventional techniques such as in-situ "slug tests" and laboratory evaluations of soil and water samples. These methods are limited in the extent and application of the information obtained. An in-situ method to obtain a broader evaluation of hydrogeological conditions for a coastal landfill has been devised. Tidal stress theory was used for the determination of an effective hydraulic conductivity in a coastal aquifer. The effective hydraulic conductivity for the refuse was found to be 6.25E-02 ft/sec.

A combination of analytical modeling methods were employed to determine the potential seepage area and seepage flux distribution. These included construction of a flow net for the landfill and time-dependent evaluation of the hydraulic gradient between the fresh water and the salt water. This revealed that the seepage was concentrated along the central coastal margin of the landfill. The average seepage flux remained constant at a rate of 1.56E-03 cfs/sf, independent of the recharge rate to the aquifer. The seepage face varied directly with

recharge. For a range of recharge from 0.038 - 0.19 cfs, the seepage face varied from 1.18 - 2.68 feet, respectively.

Groundwater quality sampling indicated concentrations of lead copper zinc and mercury in the refuse wells at 10^4ppb, 10^3ppb, 10^3ppb and 1ppb, respectively. These levels are 2 - 3 orders of magnitude greater than found in the upgradient well. Sampling of a groundwater seepage spring along the shoreline revealed undetectable levels of these same metals. Historic trends for lead and copper indicate that the levels of concentrations have been declining at the rate of 183.7 ppb/yr and 192 ppb/yr, respectively. Based on these trends, concentrations of these metals will reach background levels, 10 ppb for lead and copper, in approximately thirty years. Over this period, the total loading from lead is estimated to be 1031 pounds and from copper to be 1080 pounds.

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INTRODUCTION

The siting of landfills has long since been a practice of utilizing those pieces of land that were least desirable. For many communities, that meant finding a low-lying area, unsuitable for development. For an island community those low-lying, unsuitable areas have been in the coastal zone. This means that past siting practices usually resulted in landfills occupying environmentally sensitive areas. In the coastal environment, the combination of environmental mechanisms present unique problems not encountered in upland areas.

The coastal environment is viewed as a multi-functional environment. It provides a source of food, recreation and habitat for a myriad of wildlife, aquatic organisms and humans. The ability of marine organisms to assimilate high levels of heavy metals makes landfill leachate in a coastal environment a special concern. Leachate typically carries high concentrations of heavy metals. Older, unlined landfills tend to produce leachate for extensive periods of time. The continued production of leachate in close proximity to the coastal environment provides an excellent migration path for contaminants. This is especially true when the refuse is in continuous contact with the water table. The affects of extended exposure of marine life to concentrations of heavy metals is not entirely understood. Loureiro Engineering (1986) discussed that the effects from heavy metal exposure varies from species to species and is significantly influenced by other environmental factors such as pH, temperature and synergetic effects. They also discussed the showed that the affects on marine life differ for different metals. Their

discussions concentrated on lead, copper and nickel. The major concern involving bio-accumulation of heavy metals is the ability of high concentrations of metals to enter the food chain. This is possible through the ingestion of shellfish which have concentrated the metals from the micro-organisms on which they feed or the bio-accumulation by marine plants which are used by marine animals for food or directly by humans. Based on their potential toxic affects, the metals of greatest concern therefore are lead, for its toxicity to humans and marine biota, and copper, for its toxicity to marine life (Loureiro, 1986).

Major environmental catastrophes of the past decade have focused attention on the risks associated with past disposal practices. Numerous regulations have been promulgated by various governmental agencies in an effort to curb, mitigate and remediate affects of prior practices. This spawned much needed research in the area. However, little is still known regarding the extent of degradation coastal environments have suffered from coastal landfills. Foyn (1967) presented hypotheses concerning disposal of various wastes in coastal lagoons. He concluded that the disposal of wastes in a coastal environment, especially lagoons, required special attention and considerations. Distance from the disposal site as well as the conditions of dilution or retention time in the lagoon are the dominant factors.

More recently, Hickey (1989) presented a comprehensive approach to determine hydraulic gradients within variable-salinity ground water. The ability to estimate reliably the hydraulic gradients and flow paths in coastal environments is critical to the successful disposal of wastes. Although intended to evaluate injection-well disposal schemes,

this capability is also important in predicting the degree of contamination that will be produced by an unlined landfill.

The enormity of the pollution potential was documented by Cheremisinoff (et al, 1984). He points out that nationwide there are approximately 16,000 known or abandoned hazardous waste sites with only 539 on the Super-fund list. In addition there are over 93,000 municipal and industrial landfill sites. Cheremisinoff (1984) points out that over 75% are unlined and that approximately 18,500 are producing liquid leachate. Recent legislation has been enacted to curtail environmentally unsound practices. However, the task of remediation for the majority of the sites is still ahead.

As a result of poor siting and control, contamination from coastal landfills has contributed to numerous miles of coastline being closed to fishing and shell fishing and, in some cases, recreation. These closures have been predicated on information derived directly from contaminant level sampling of marine life and pollution migration predictions. Closure area determinations are highly dependent on frequent and continued marine life sampling. This can prove to be very costly for a community dependent upon the water body for significant revenue.

BACKGROUND

Landfill History

The object of this study, the McAllister Point Landfill, is located in Middletown, Rhode Island and is owned by the Naval Education and Training Center, Newport, Rhode Island. Figure (1) indicates the general location of the landfill. It is situated approximately 2 miles north of the Naval Base complex along the western shore of Aquidneck Island. The landfill lies between the Defence Highway and the Narragansett Bay. The proximity of the McAllister Point Landfill to the Narragansett Bay is shown in Figure (2).

The landfill was utilized from 1955 to 1973 by the US Navy. It was the disposal site for all municipal and industrial wastes generated within the naval complex. From 1960 to 1971, a teepee incinerator was utilized for burning the refuse prior to landfilling. In 1971, in compliance with state direction, incineration was halted and the facility was converted to a sanitary landfill. The facility was closed in 1973 and three feet of cover material was installed. During its time of operation, it is estimated that the facility handled 50 tons of waste per day (Envirodyne, 1983). The landfill was created by direct dumping into a salt-water marsh. As more space was needed, the refuse was extended into the bay, creating the point as we know it today. The refuse varies from 15 to 38 feet in depth due to the irregular nature of the underlying bedrock and till materials. This has produced a topographical relief approximately 20 to 30 feet above mean sea level

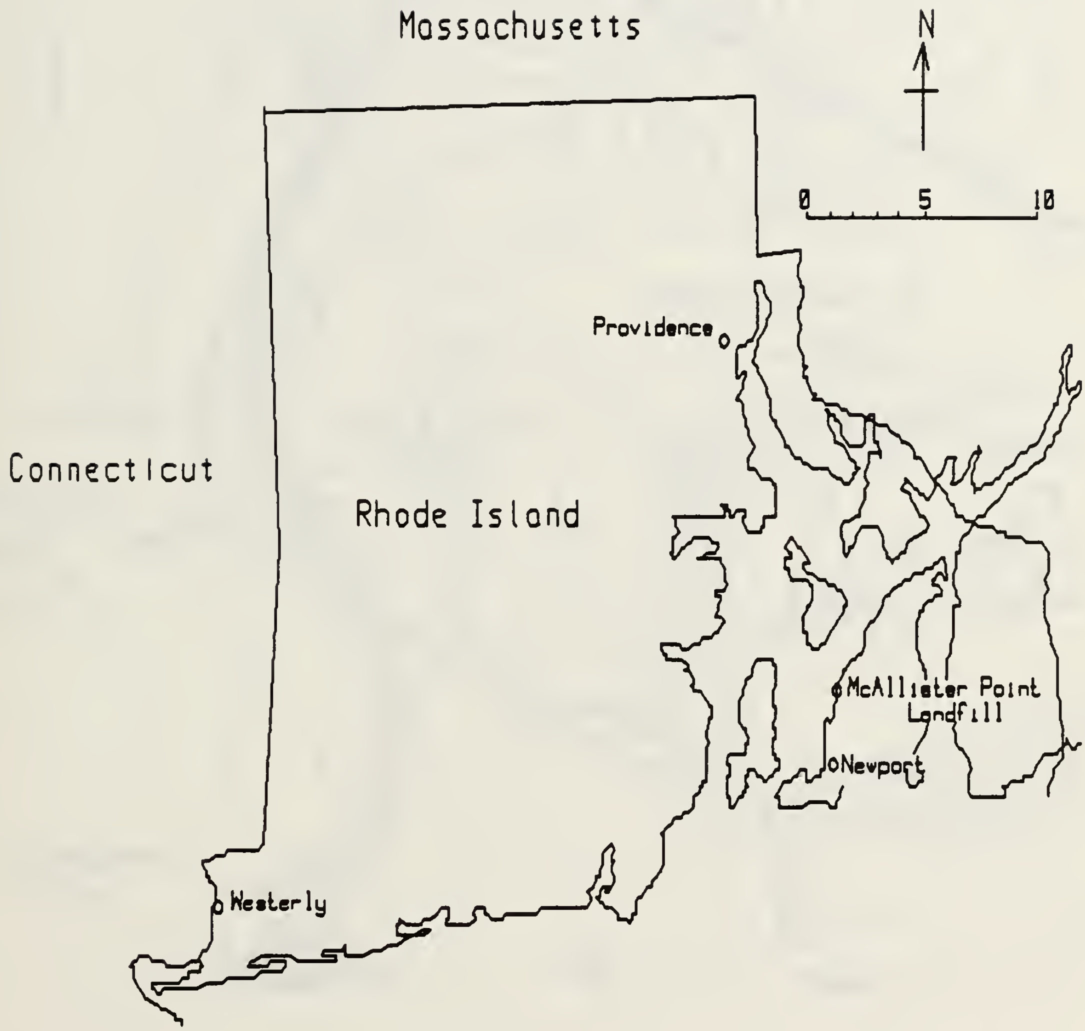

Figure 1. General Location Map of McAllister Point Landfill

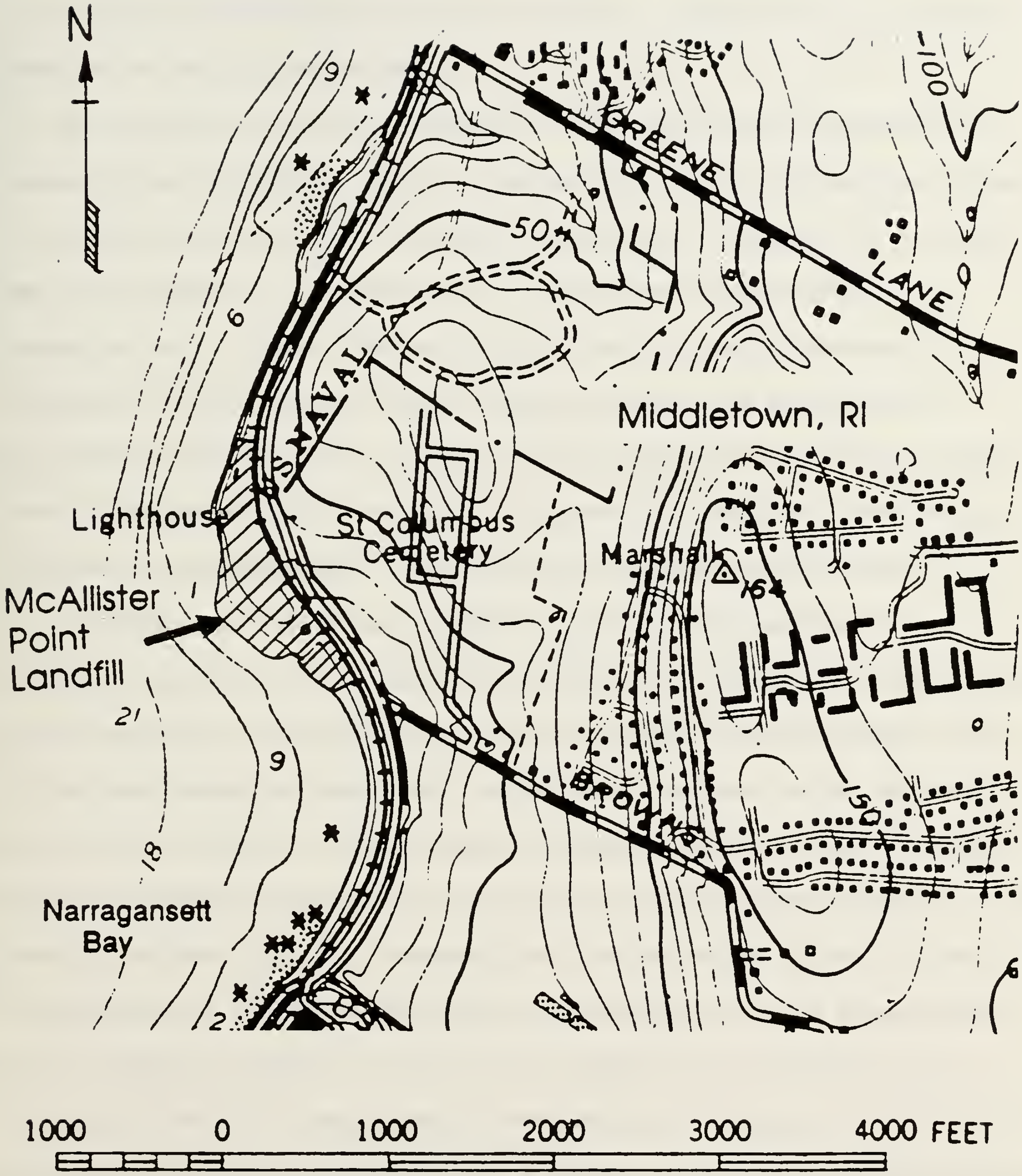

Figure 2. Site Map of McAllister Point Landfill

(Envirodyne, 1983). The disposal site is bounded on the north by a bedrock wall, on the east by the Old Colony Railroad Line, NUSC Stream to the south and Narragansett Bay to the west. The base of the landfill bank is at the high water mark.

In 1980, the US Navy initiated the Navy Assessment and Control of Installation Pollutants (NACIP) program. Under this program, the US Navy must identify, assess and control environmental contamination from past use and disposal of hazardous waste at Navy and Marine Corps installations. The Naval Education and Training Center embarked on implementation of the Navy NACIP program locally and commissioned Envirodyne Engineers, Inc. to prepare an Initial Assessment Study. This study identified McAllister Point as a potential source of continuing pollution and recommended it for a follow-on confirmation study.

A confirmation study was conducted in 1986. The purpose was to verify the results of the Initial Assessment and characterize the nature of the problem. The Confirmation Study concluded that the landfill had or was continuing to contribute contaminated leachate to Narragansett Bay. Elevated levels of lead, copper, chromium and nickel were found in the bay sediments and shellfish near the south end of the landfill. "The Groundwater sampling data suggests that the migration pathway of the contaminants is via groundwater but the concentrations of these metals do not seem high enough to point to the underlying groundwater as a continuing source of environmental contamination" (Loureiro, 1986). The Confirmation Study recommended that a Remedial Investigation/Feasibility Study (RI/FS) in accordance with the 40 CFR 300.68 be undertaken due to strong indications that the landfill could be contaminating the bay.

McAllister Point is currently being evaluated in the framework of a RI/FS by TRC Environmental Consultants. All data, with the exception of the periodic groundwater observations, used in the preparation of this thesis was gathered by TRC Environmental Consultants. The results of the RI/FS study will be the recommendation of definitive remedial actions to be taken at the site. The study is currently on-going and is scheduled to be completed in the Fall of 1991.

Geology

The bedrock underlying the landfill is of the Rhode Island Formation. This is the thickest and most extensive of the Pennsylvanian Age formations. The Rhode Island Formation includes fine to coarse conglomerate, sandstone, lithic graywacke, graywacke, arkose, shale and a small amount of meta-anthracite and anthracite. Crossbedding and discontinuous bedding are typical. The bedrock in this area tends to be highly variable. This is evident by the outcroppings at the north end of the site, bedrock depths as much as 20 feet below sea level at the south end of the site to bedrock depths rising to 40 ft above sea level to the east (Envirodyne, 1983). These variations occur in an area of approximately ten acres. Bedrock elevations and depth below land surface throughout the landfill are summarized in Table 1.

Table 1. Bedrock Elevations at Monitoring Well Locations

Well ID	Elevation (ft MSL)	Depth to Bedrock (ft)
MW-1D	21.5	8
MW-3D	7.5	24
MW-4S		
MW-5D	-6.0	23
MW-10D		
MW-11D	5.0	7

The underlying bedrock has a uniform slope of 0.06 ft/ft downward in the direction of Narragansett Bay as indicated in Figure (3).

Climatology

The climate at McAllister Point is significantly influenced by its proximity to Narragansett Bay and the Atlantic Ocean. The winters are moderately cold and the summers are generally mild with sea breezes often cooling the summer days.

The temperature averages 50°F year-round. The coldest temperatures occur in January and February and average 29°F. The warmest temperatures occur in the month of July and average 72°F. The growing season averages 195 day, beginning in mid-April and lasting until late October. Sub-zero temperatures are seldom encountered. The temperature extremes experienced have been from -13°F to 104°F.

The average annual precipitation is 42.75 inches. Measurable precipitation occurs on one day of every three and is well distributed throughout the year. Thunderstorms are the source of most precipitation from May through August. Table 2 summarizes the monthly precipitation realized at McAllister Point for the period of January 1987 through

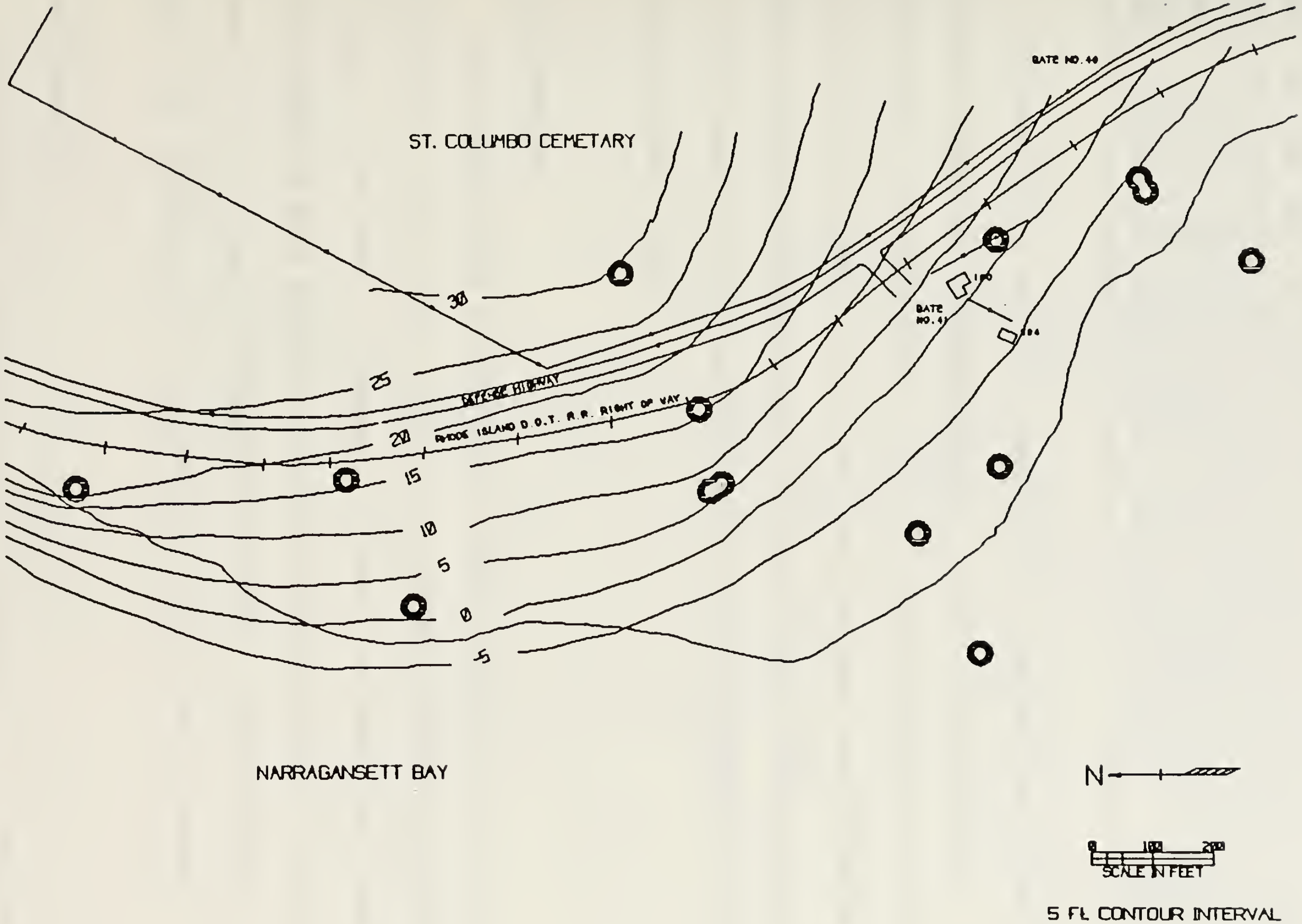

Figure 3. Bedrock Contours at McAllister Point Landfill

October 1990.

Table 2. Precipitation Data, Lawton Valley Reservoir

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
87	5.01	0.83	5.74	7.12	2.18	1.76	0.80	2.59	7.67	3.31	5.55	2.04	45.40
88	2.77	6.81	4.74	2.35	2.35	3.16	6.40	1.00	2.03	1.99	8.03	1.82	43.45
89	1.82	2.71	4.87	4.74	4.73	4.30	5.40	4.94	5.12	7.45	5.08	1.73	52.89
90	5.89	3.97	1.98	5.06	5.14	1.67	5.98	0.99	2.90	4.62			38.20

The McAllister Point is susceptible to damage from severe weather. The area experiences severe weather in the form of tropical storms and hurricanes. The probability of a hurricane striking the area is less than one in fifteen in any given year. The most severe damage occurs when the storm strikes at high tide. The damage that would be suffered at McAllister Point is beach erosion which would expose refuse deposited along the shoreline.

Tidal Regime

The tidal regime at McAllister Point is characterized by a semidiurnal tidal cycle, with the principal variations following the changes in the Moon's distance and phase. The mean tide range is 3.5 feet having a mean duration of 6 hours and 31 minutes. The maximum single tide has been 9.06 feet MSL and the lowest has been -2.44 feet MSL. Both extremes have occurred during major storm events.

Hydrogeology

Groundwater at McAllister Point is generally very shallow. The water table being approximately ten to fifteen feet below the surface. This shallow depth means that some portion of the refuse exists in a

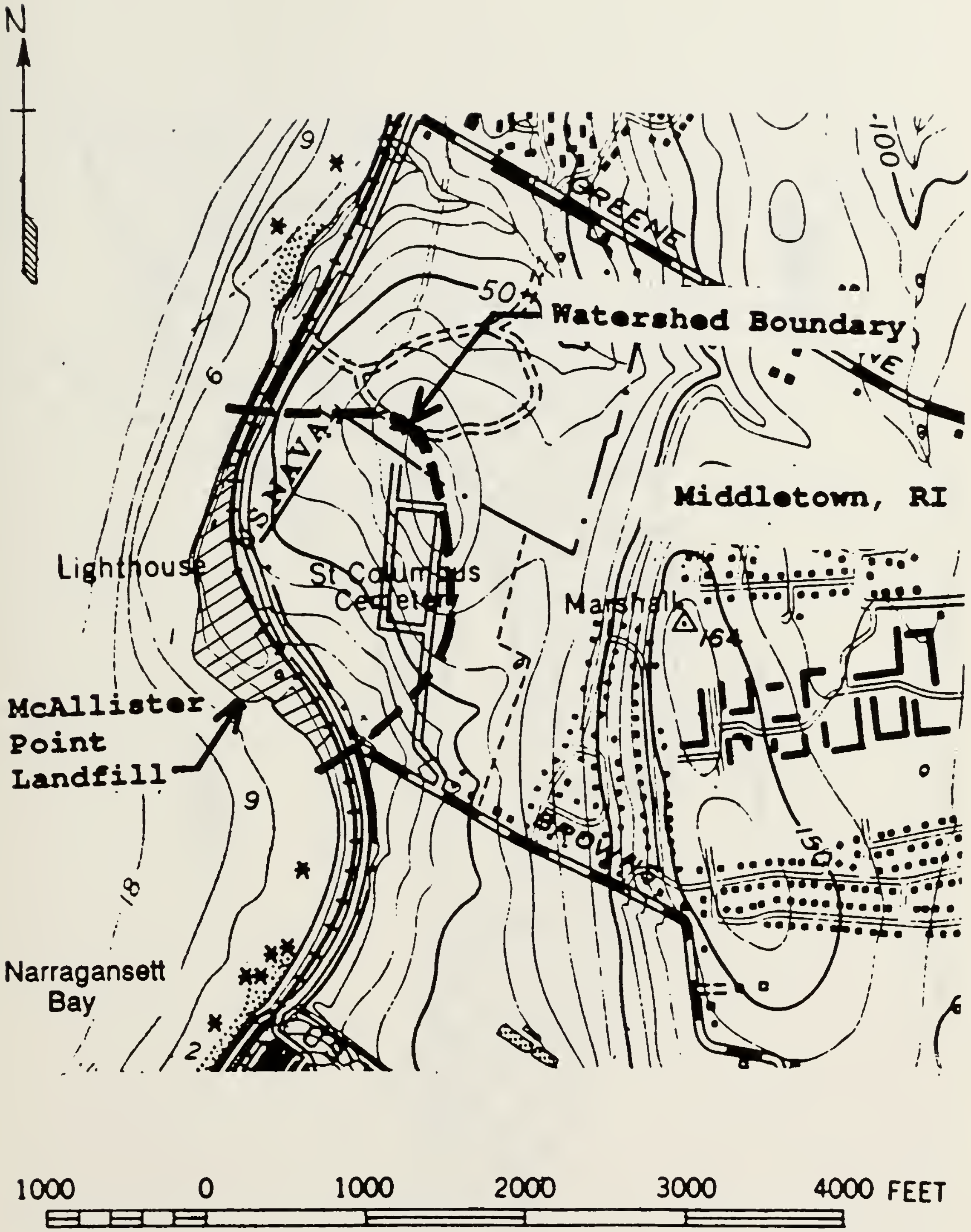

Figure 4. Contributing Watershed Boundary Delineation

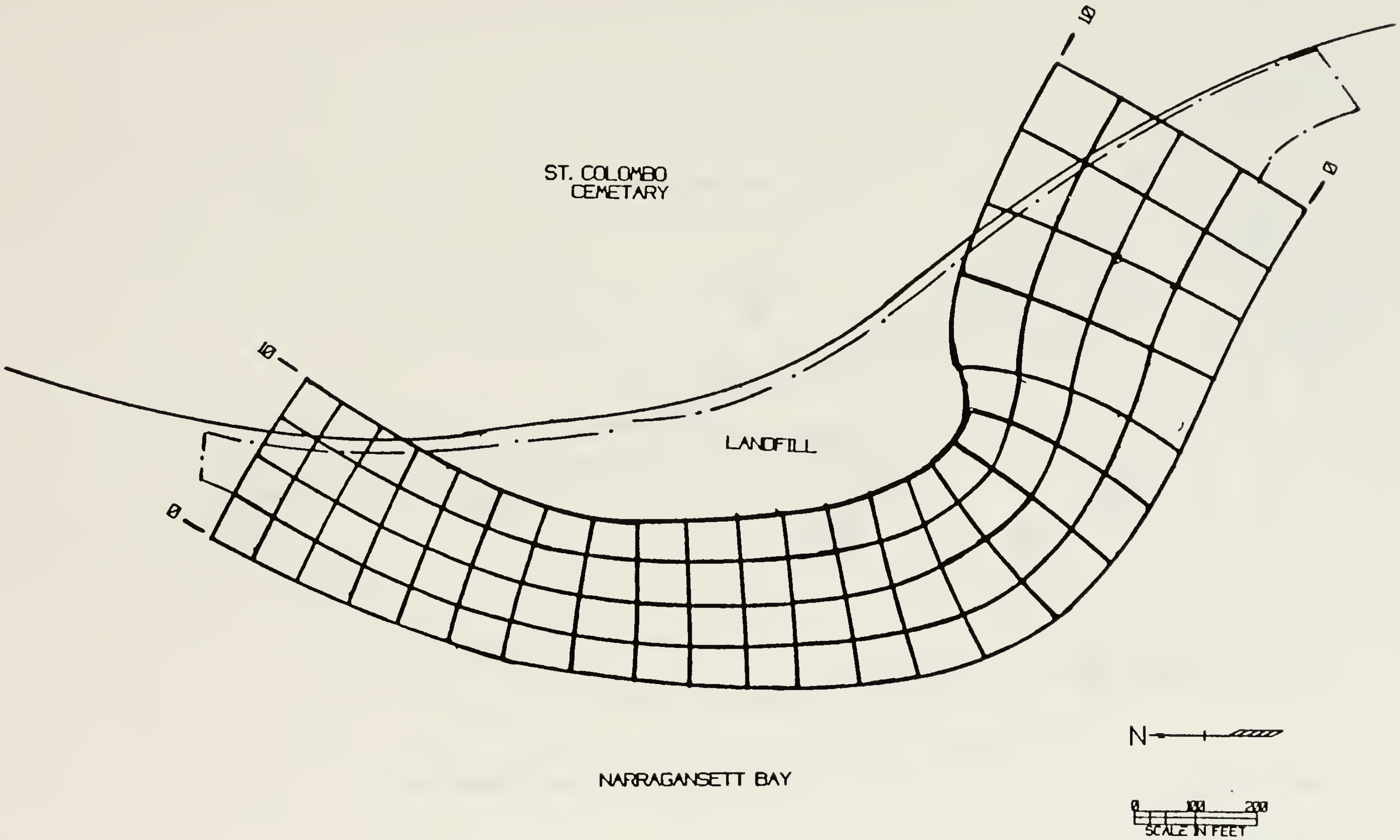

Figure 5. Flow Net of McAllister Point

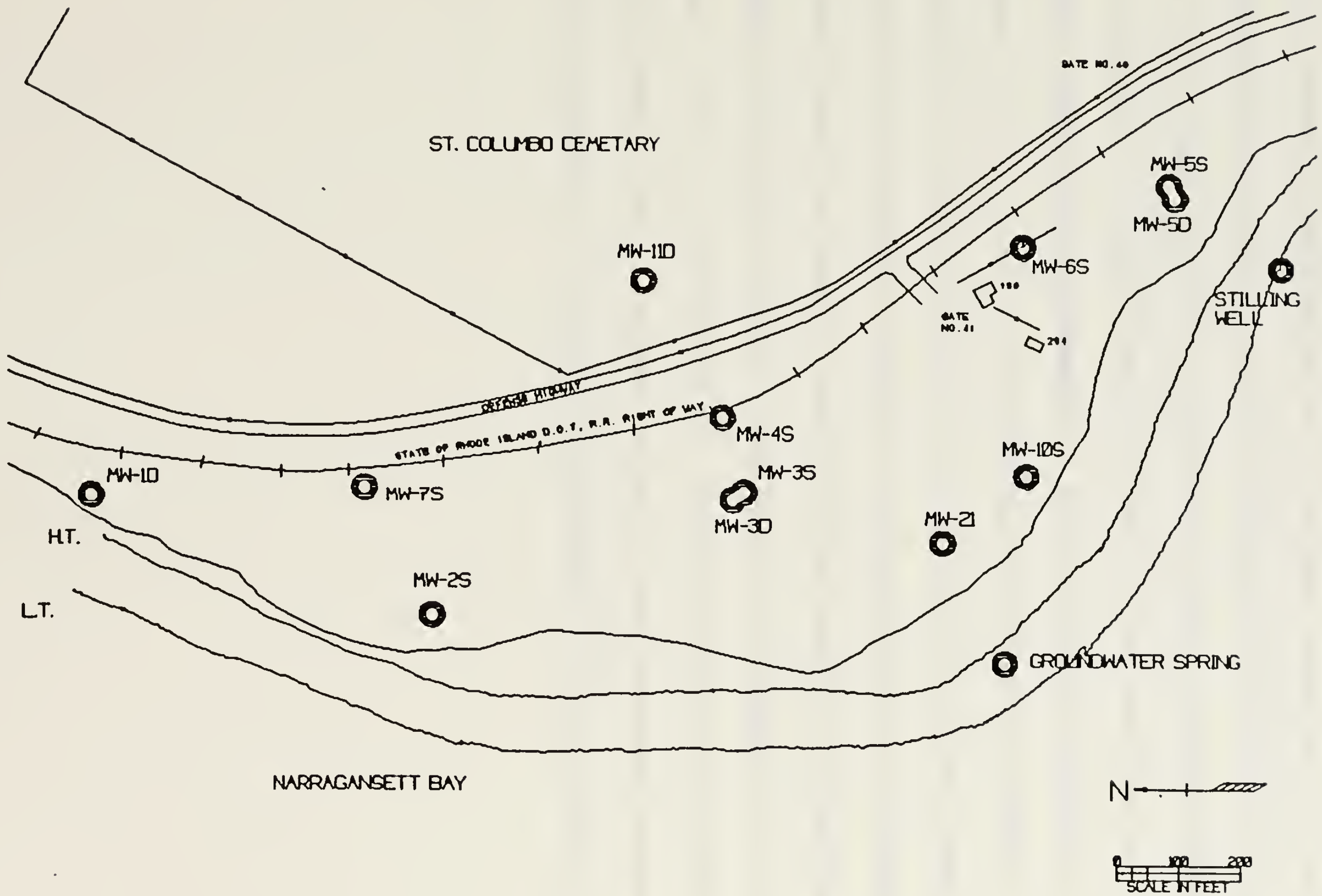

Figure 6. Monitoring Well, Stilling Well and Seepage Spring Location

continually saturated condition. The contributing watershed is indicated in Figure (4), and encompasses approximately 57 acres. The groundwater divide is assumed to correspond to the surface watershed delineation. This assumption is supported by the combination of the shallow depth to bedrock in the area (typically less than 20 feet) and the decrease in surface elevation of approximately 25 feet on the east side of the topographic high along the cemetery's north boundary. The flow of groundwater is in a westerly direction as indicated in Figure (5). The concentration of flow paths is in the central area of the landfill. This area also has the steepest gradient, thus the majority of groundwater will flow through the central portion of the landfill. Migration of groundwater through the landfill results in its emergence in the near shore area. Figure (6) indicates the location of what is believed to be a leachate spring. Other seepage springs in this area and further south have been documented in the Initial Assessment and Confirmation Studies.

Monitoring Wells

Monitoring wells used in this study for field surveillance were installed by TRC Environmental Consultants, Hartford, CT and Loureiro Engineering Associates, Avon, CT.. A total of 12 wells have been installed for evaluating the site. Figure (6) shows the location of each monitoring well. The majority of the wells have been located in that area of the landfill considered to be under the greatest influence of groundwater migration. The typical construction of the monitoring wells by TRC Environmental Consultants is as indicted in Figure (7) . Construction of monitoring wells by Loureiro Engineering Associates is assumed to be similar. Table 3 summarizes the characteristics of each well. Stratigraphy drawings and boring logs for wells are contained

Table 3. Monitoring well characteristics

Well ID	Reference Elevation (ft MSL)	Screened Interval (feet)	Bottom of Boring (feet)	Well Diameter (inch)	Well Material
MW-1D	31.77	20 - 35	38	2"	PVC
MW-3D	34.28	27 - 42	44.5	2"	PVC
MW-3S	34.04	12.5-22.5	26	2"	PVC
MW-5D	20.57	27.5-42.5	48	2"	PVC
MW-5S	20.32	4 - 14	17	2"	PVC
MW-6S	22.89	4 - 14	14	2"	PVC
MW-7S	32.88	10 - 20	30	2"	PVC
MW-10D	17.76	15 - 25	30.3	2"	PVC
MW-11D	40.71	30 - 40	40	2"	PVC

in Appendices (F) and (G).

For the purpose of this study, only 9 of the wells were monitored. The data obtainable from the other three was considered to be

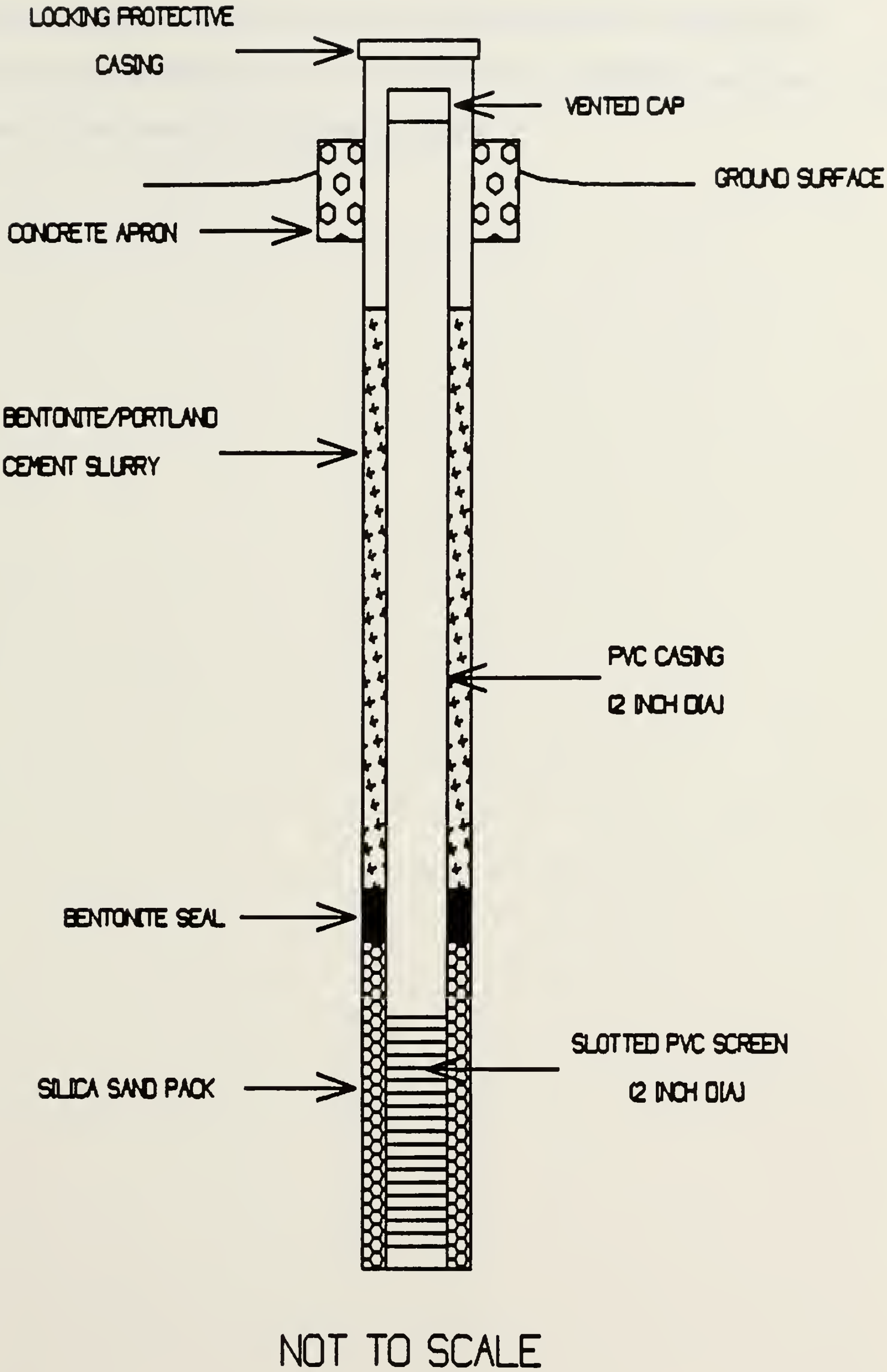

Figure 7. Typical Monitoring Well Construction (TRC, 1988)

unreliable. This is because MW-2 never indicated a definitive water level, MW-4 became a victim of silt migration causing unreliable readings and surface subsidence in the vicinity of MW-21 resulted in the disturbance of the seal around the casing.

FIELD METHODS

Periodic Water Level Measurements

Periodic monitoring of the water levels in the monitoring wells was performed during the period of June - September 1990. Water level measurements were accomplished by use of a chalked, fiberglass tape. Surveillance was performed twice a week, with two readings taken at six hour intervals on each monitoring day. The two readings for each day were averaged to account for fluctuations in the water table due to short-term tidal stress. The tidal period in Rhode Island is approximately 6 hours and 15 minutes. By obtaining water level elevations on the same frequency as the tidal cycle, then the average of the tide elevation will be equal to the mean tide elevation for the day. And the average elevation of the water table will be the water table elevation corresponding to the mean tide elevation. Periodic observation data is contained in Appendix (A). All water level measurements and elevations were referred to local Mean Sea Level as determined by the National Oceanic and Atmospheric Agency, Datums Section for station 8452660, Newport, RI. which is located approximately one-quarter of a mile south of the landfill.

Continuous Water Level Measurements

Continuous measurements of monitoring well sites 1, 3, 5, 6, 7 and a stilling well in the bay was performed from 20 August - 24 August 1990. This monitoring was accomplished in an effort to determine the

characteristic response of each monitoring well to the stress imparted by the tidal fluctuation. Results of this monitoring are contained in Appendix (B). This phase of the field work was accomplished as a coordinated effort with the field investigators from TRC Environmental Consultants. TRC Environmental provided two DL-250 data loggers for surveillance of the monitoring wells at locations 1,3,5,6,7. The Civil and Environmental Engineering Department provided one DL-150 data logger for monitoring the stilling well. Data was recorded at fifteen minute intervals for all monitored wells. Manual water level monitoring was conducted during this phase for calibration of the data logger output.

Bedrock Hydraulic Conductivity Determination -

TRC Environmental Consultants performed in-situ slug testing (Hvorslev, 1951) of the bedrock wells, MW-1D, MW-3D and MW-5D. Table 4 summarizes the results of these tests. Efforts to determine permeability of those wells screened in the refuse were unsuccessful. This is because the screened interval was not fully submerged below the water table, resulting in instantaneous recovery of the water level.

Table 4. In-situ values of bedrock hydraulic conductivity

Well	Hydraulic Conductivity
MW-1D	1×10^{-3} cm/sec
MW-3D	4×10^{-4} cm/sec
MW-5D	5×10^{-4} cm/sec
MW-10D	3×10^{-3} cm/sec
MW-11D	5×10^{-4} cm /sec

The time-lag or "slug type" permeability tests were conducted using the following method:

1. A displacing dipper of known volume is inserted in the well pipe to a known depth and the water level in the well is allowed to stabilize.
2. A known volume of water is purged from the well pipe.
3. Water level measurements were taken every ten to fifteen seconds until the well returned to equilibrium.
4. The recorded drawdowns are normalized by dividing by the initial drawdown.
5. The normalized drawdowns are plotted versus time using semi-logarithmic paper. The normalized drawdown on the log axis and time on the arithmetic axis.
6. A straight line is then fitted to the data and two points on the line are chosen.
7. The well configuration is evaluated for a value of F based on well radius, screen length and aquifer type, confined or unconfined.
8. The solution for hydraulic conductivity is then effected by evaluating equation (1) for the times and drawdowns selected.

$$T_o = \frac{\pi r^2}{FK} \qquad (1)$$

TRC Environmental performed this analysis through the use of a computer model presented by Thompson (1987). This program performs the well shape evaluation based on user input of well characteristics and chooses the correct form of equation (1). This routine provides for automated data reduction and line fitting with user intervention to eliminate those

data points in the early and late portions of the curve if they do not conform to a linear trend. The program also evaluates the fit of the line and reports a regression coefficient. The r^2 values for the regression of the line were all above 0.95.

WATER TABLE FLUCTUATIONS

Groundwater fluctuations at McAllister Point can be classified into two categories, deep well and shallow well observations. Each category displays unique trends with minor exceptions. It should be noted that long term observations would indicate seasonal variations in the water table similar to those observed in reference wells located elsewhere in Rhode Island. The position of the water table in the annual water table cycle can be determined by relating water table measurements there to measurements for reference well CHW-18, Charlestown, RI for the period of January 1990 - October 1990. Figure (8) indicates that groundwater in the Charlestown well was the highest in the month of May and declining through the month of October. For the observation period, 8 June 1990 - 28 August 1990, CHW-18 exhibited a declining trend in the water table. Figure (8) compares observation data in MW-5S at McAllister Point to CHW-18 and indicates that the water table trend at McAllister Point follows is similar to that observed to that at other locations in the state.

Deep well observations

MW-1D, MW-3D and MW-11 exhibit sharp declines in head during the early part of the observation period as indicated in Figures (9) - (12). This would indicate that these wells are located in bedrock material with low potential for water storage. The sharp increase in elevation on approximately 3 August is in response to two rainfall events,

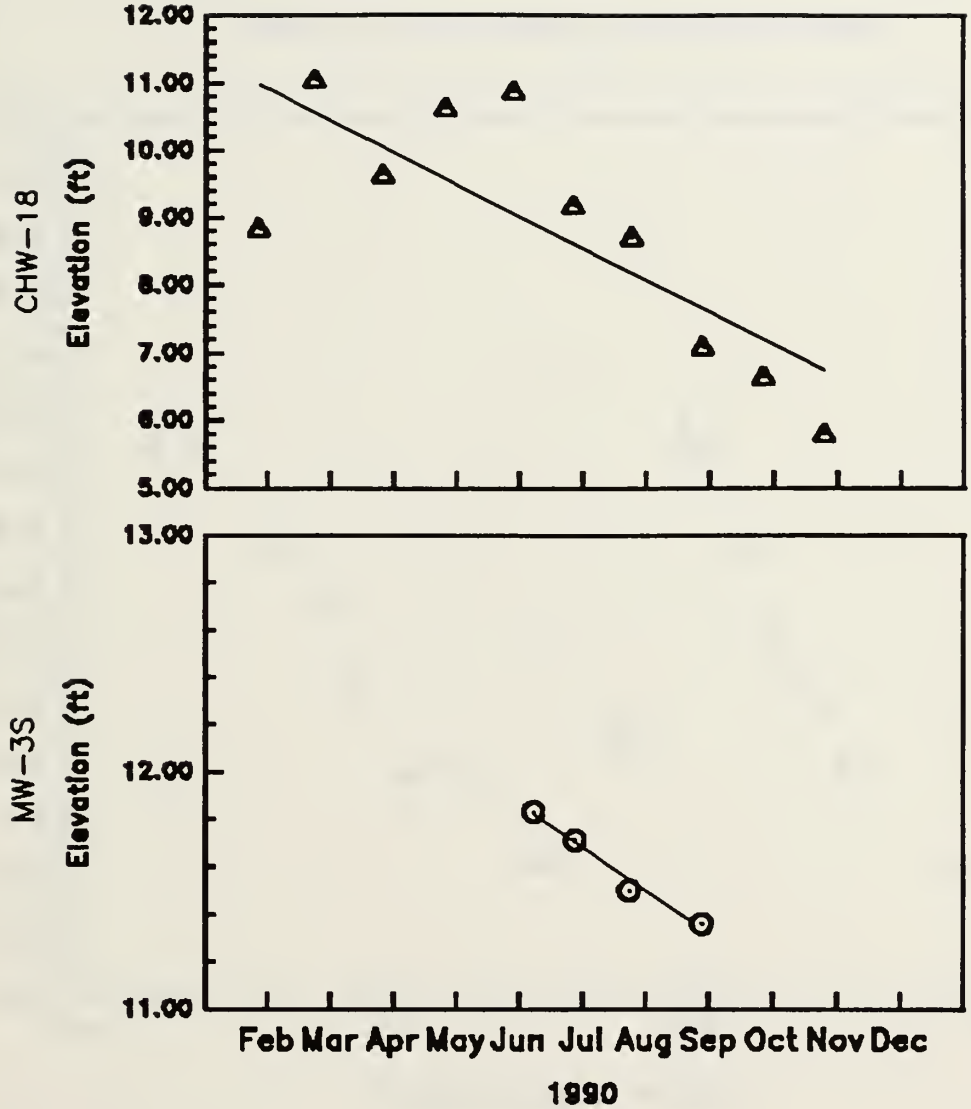

Figure 8. Comparison of Water Table Trend at McAllister Point to Reference Well CHW-18

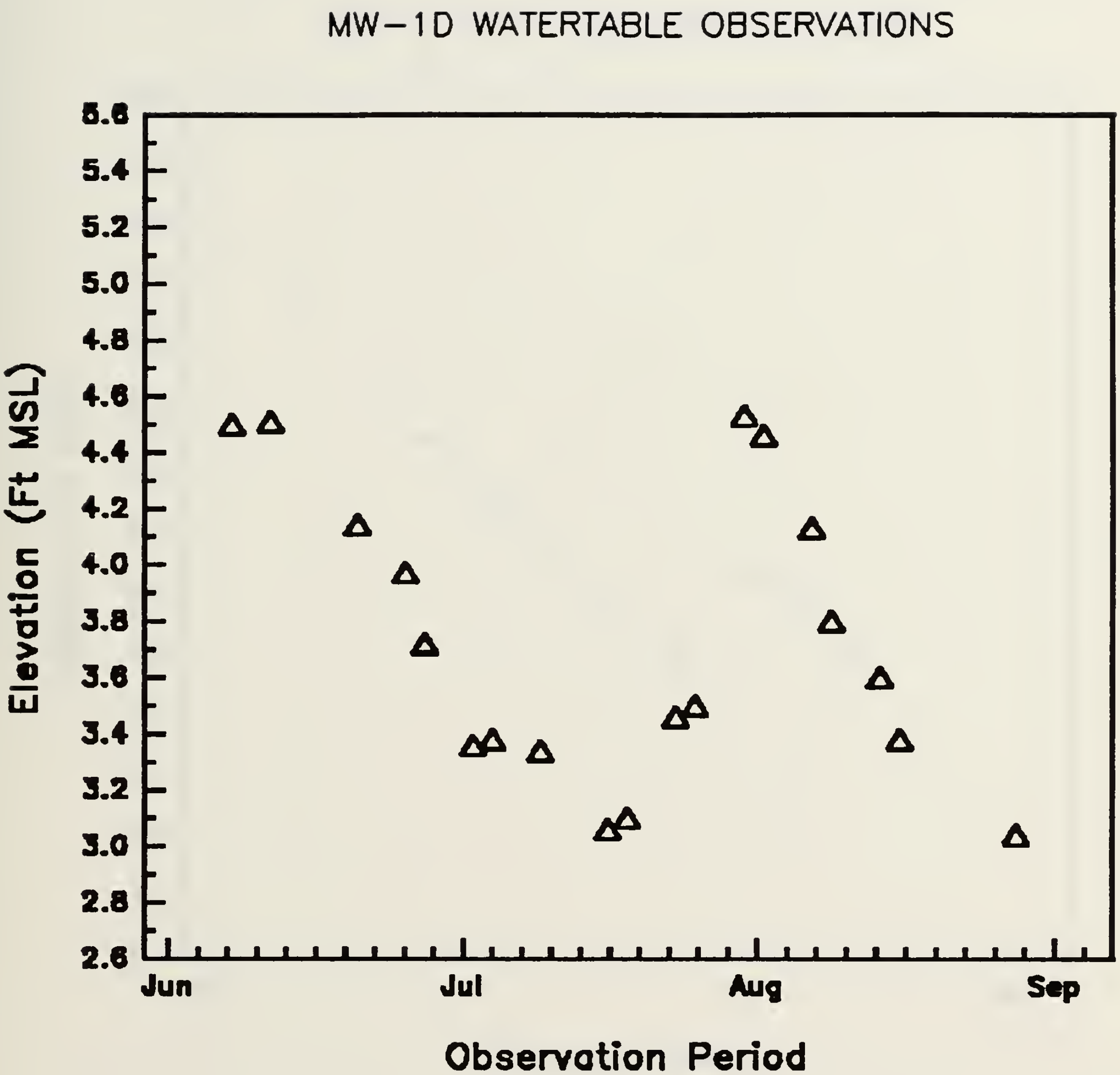

Figure 9. Water Level Observations - MW-1D, 8 June - 28 August 1990

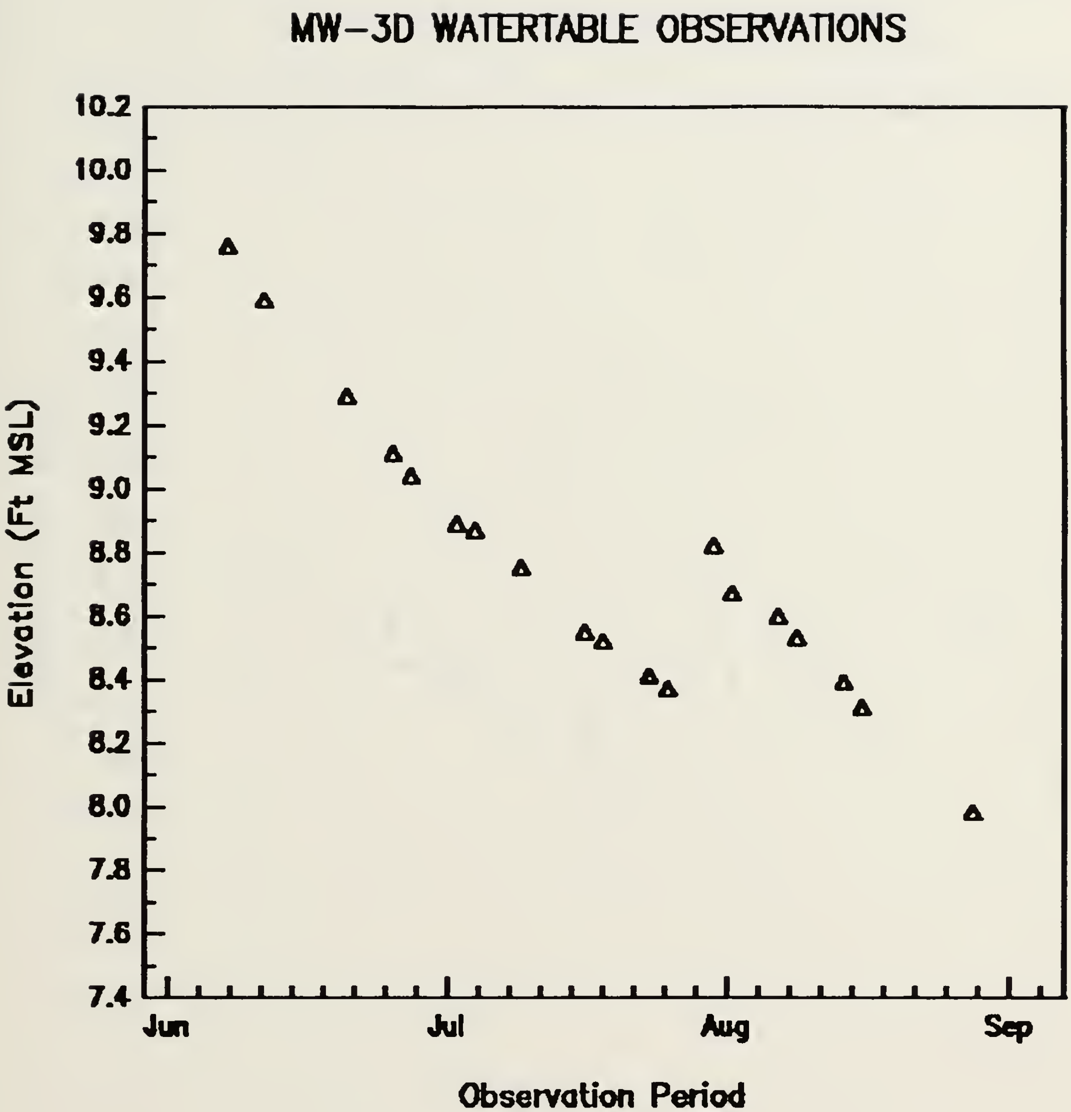

Figure 10. Water Level Observations - MW-3D, 8 June - 28 August 1990

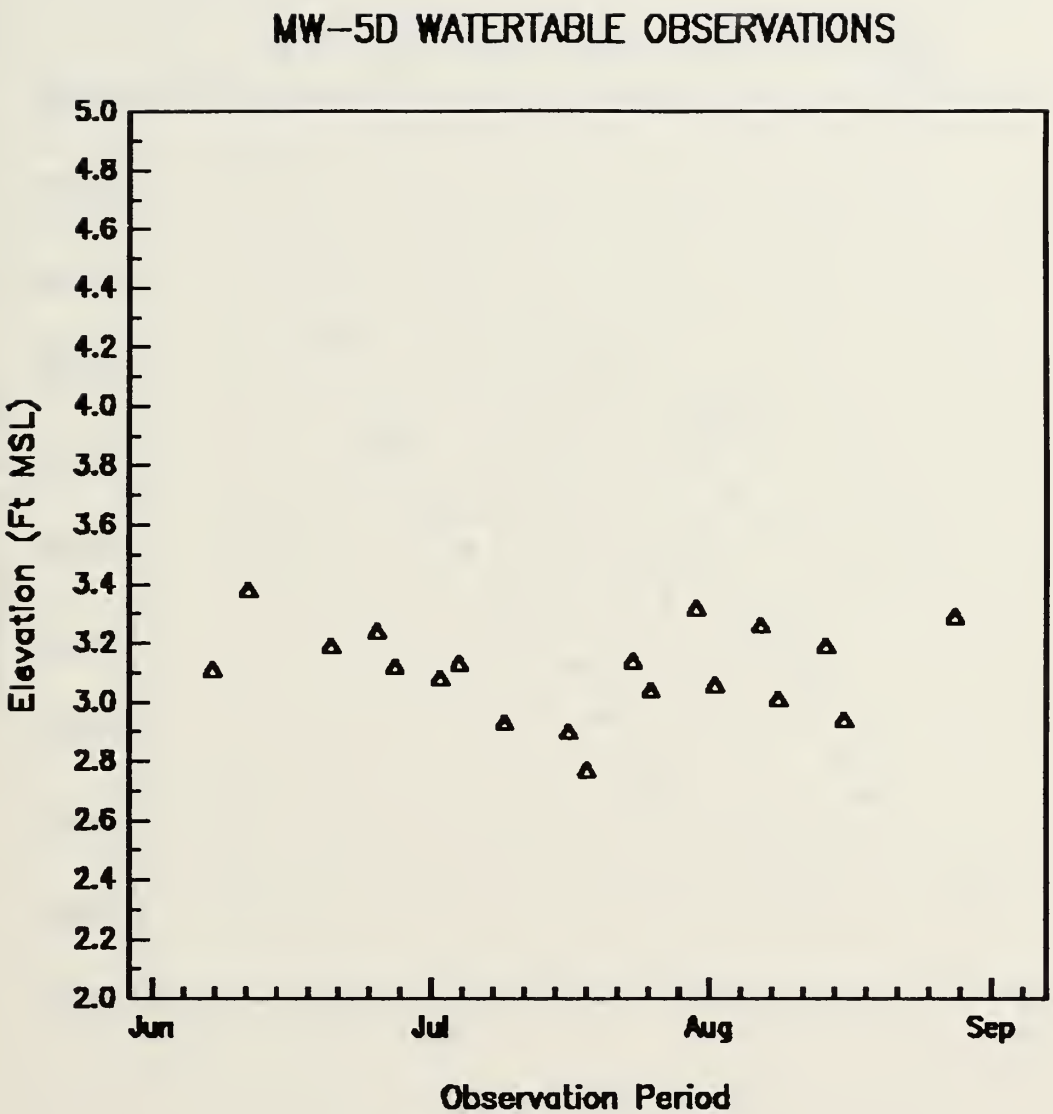

Figure 11. Water Level Observations - MW-5D, 8 June - 28 August 1990

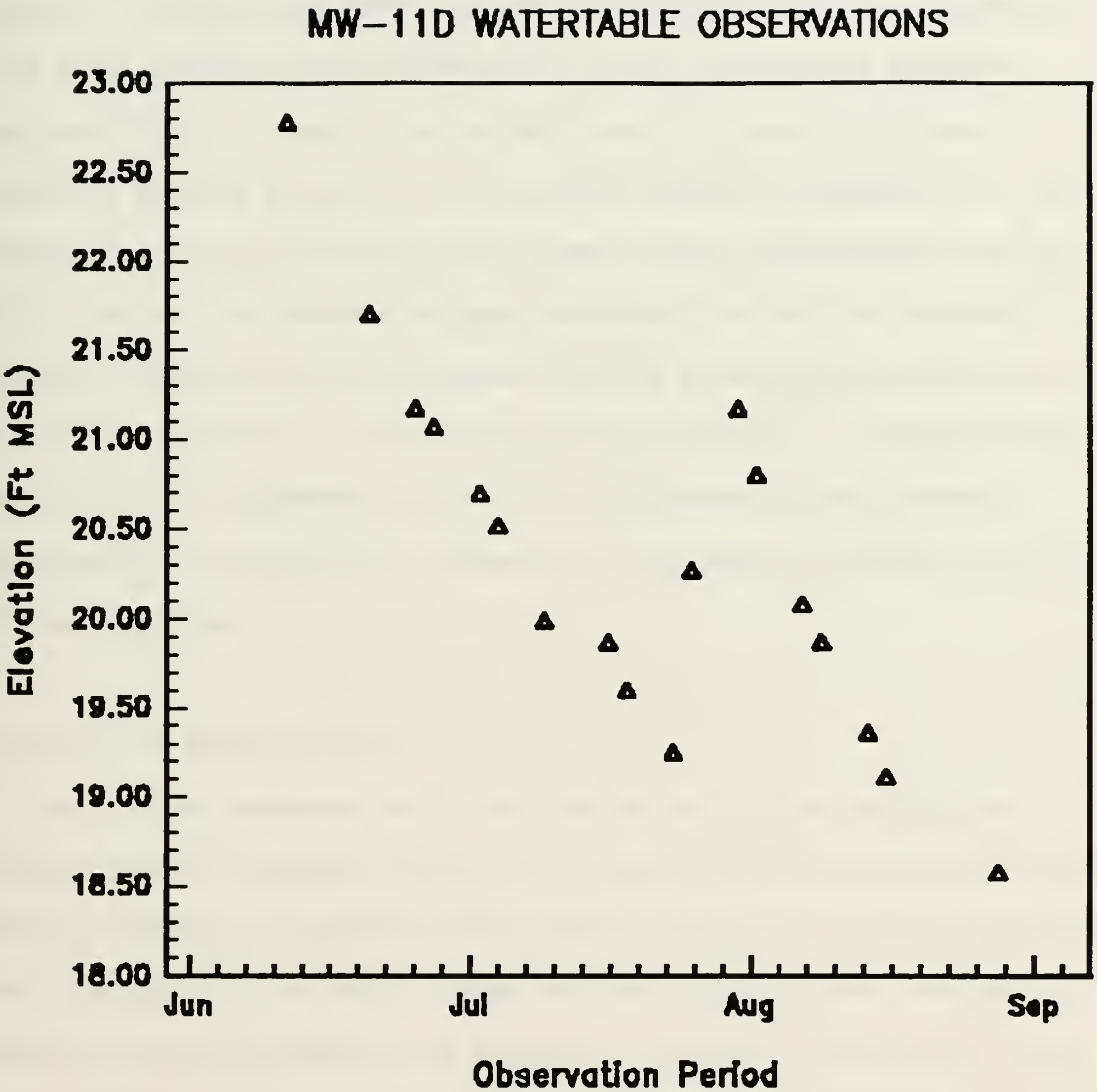

Figure 12. Water Level Observations - MW-11D, 8 June - 28 August 1990

25 & 27 July, which provided a total precipitation of 3.10 inches. This response indicates that the recharge to the aquifer for these wells is fairly unrestricted. This is probably due to the highly fractured nature of the shale material in combination with the shallow depths at which bedrock is encountered. MW-5D conversely exhibited minor fluctuations. This would indicate that the aquifer at this location is somewhat isolated from the rest of the bedrock aquifer system. This could be caused by several factors. It is possible that the overlying till and weathered shale/clay material has formed a more impermeable layer at this location, the bedrock is more competent, the well is located in a different flow path from the other wells or a combination. The most probable explanation is that the deeper groundwater is isolated due to a combination of impermeability of overlying materials and bedrock competency. This essentially causes the groundwater in MW-5D to act as a confined aquifer.

Shallow Well Observations

Water level observations in the shallow wells also follow the general trend of seasonal decline. All wells with the exception of MW-3S showed a definite response to the rainfall events of 25 July and 27 July (Figures 13 - 17). At MW-7S, MW-6S and MW-5S, Water level response ranged from an increase of 0.9 feet to an increase of 4.6 feet. While MW-3S exhibited no noticeable increase and MW-10S increased 0.3 feet. The large increases at MW-7S,6S and 5S could be attributable to the use of improper materials for landfill closure. Boring logs for MW-6 & 7 indicate the presence of fine sand with some silt as the only material covering the refuse. In addition this material is very shallow, 2 -

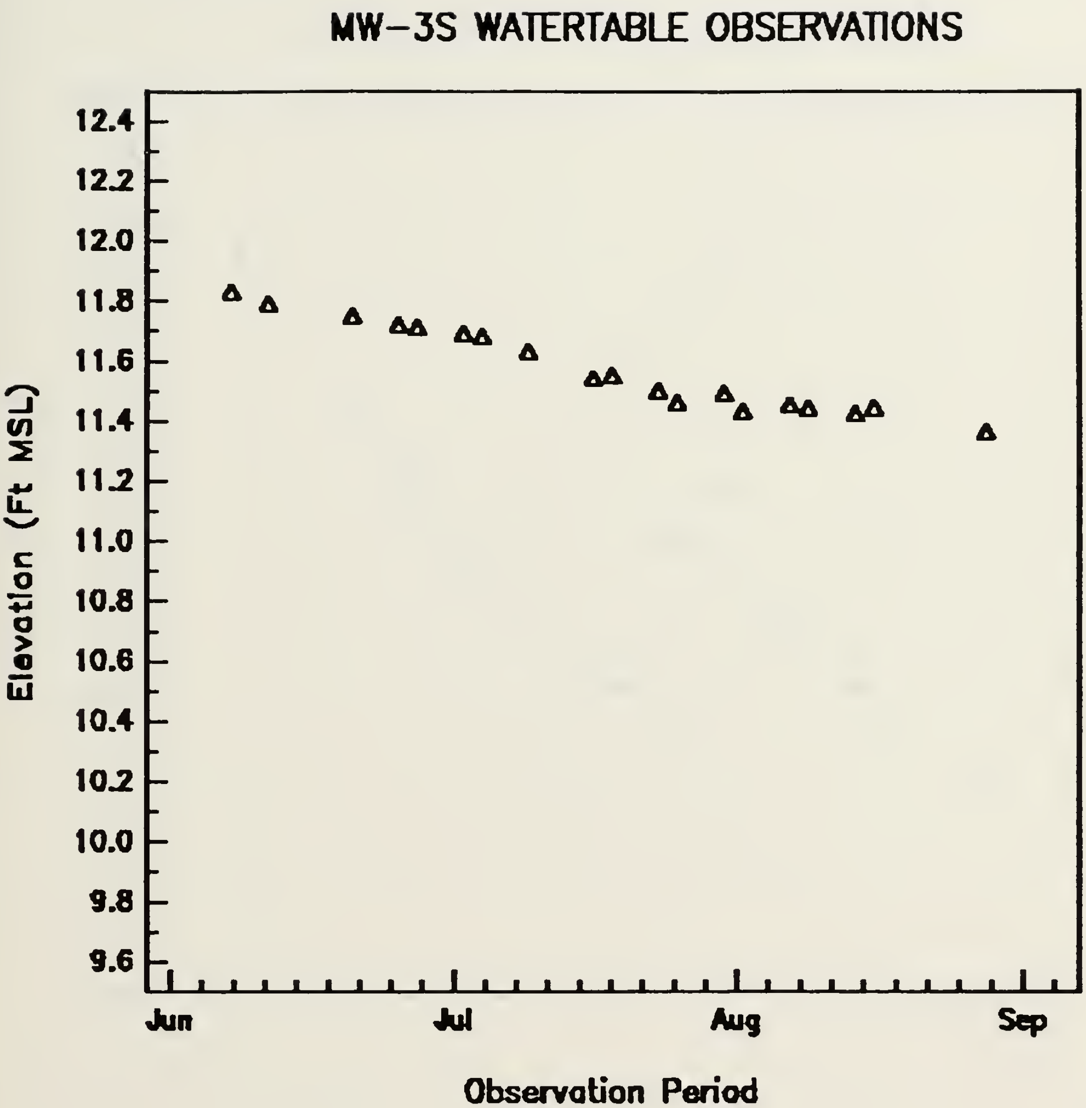

Figure 13. Water Level Observations, MW-3S, 8 June - 28 August 1990

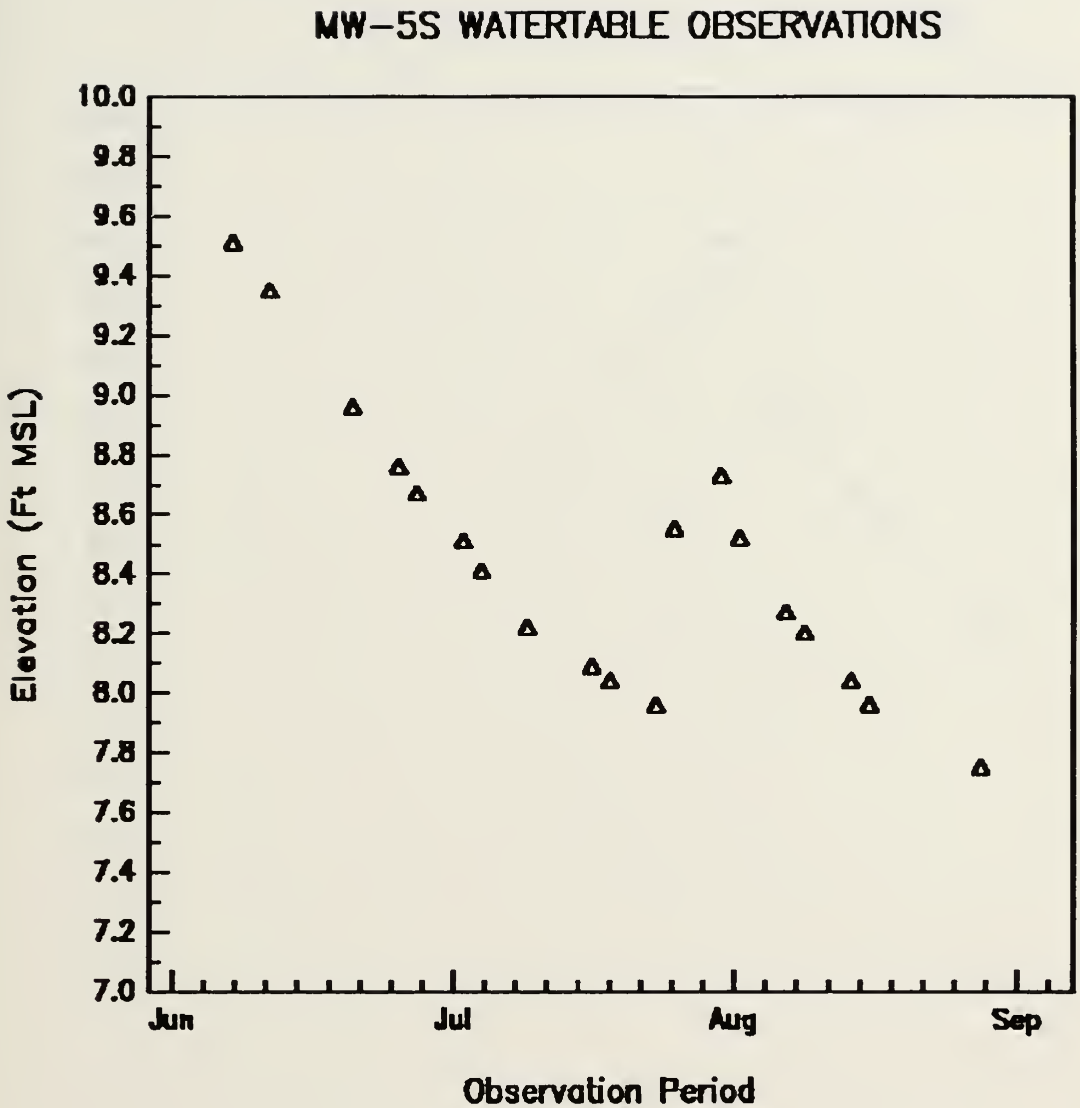

Figure 14. Water Level Observations, MW-5S, 8 June - 28 August 1990

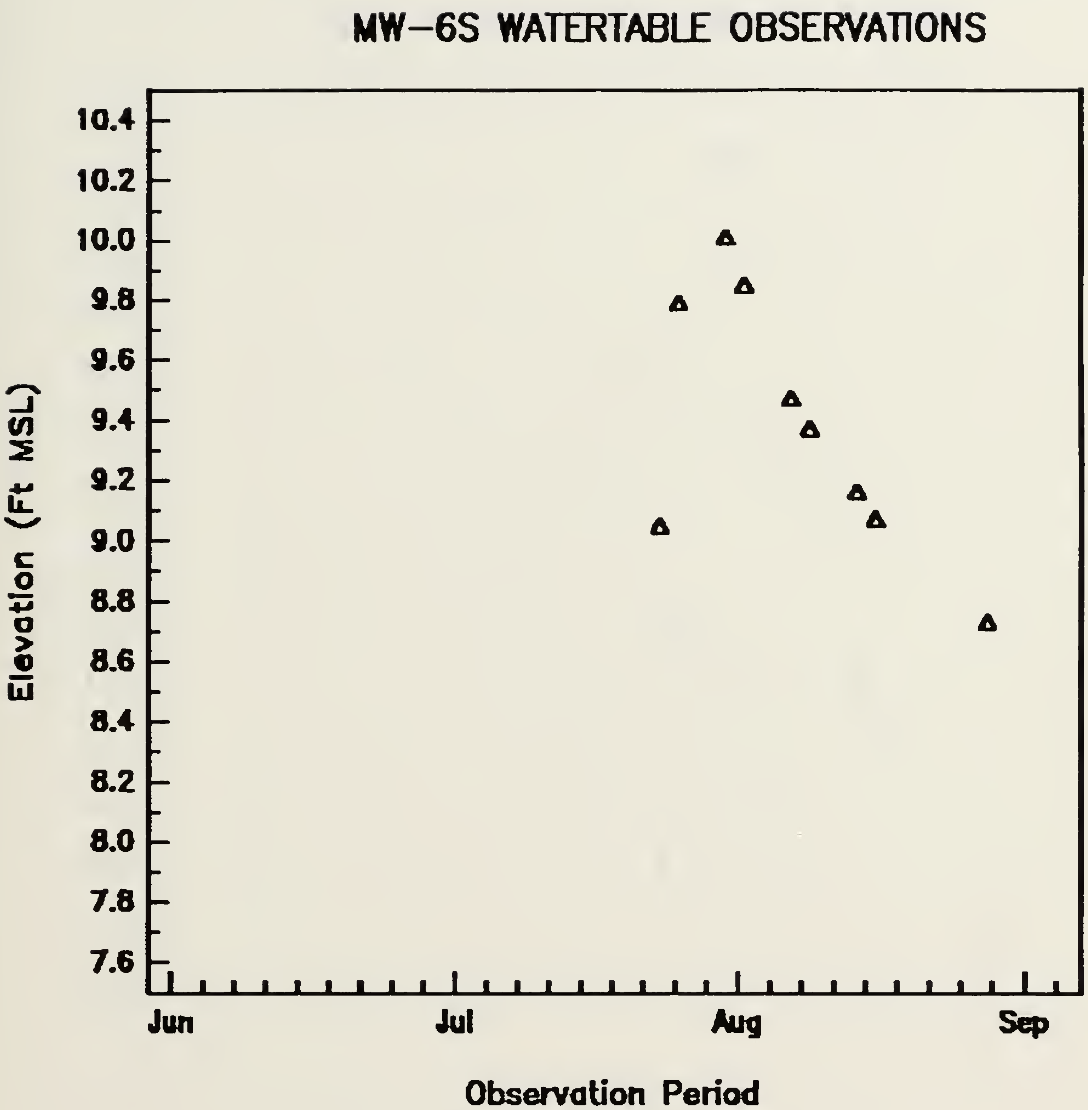

Figure 15. Water Level Observations, MW-6S, 8 June - 28 August 1990

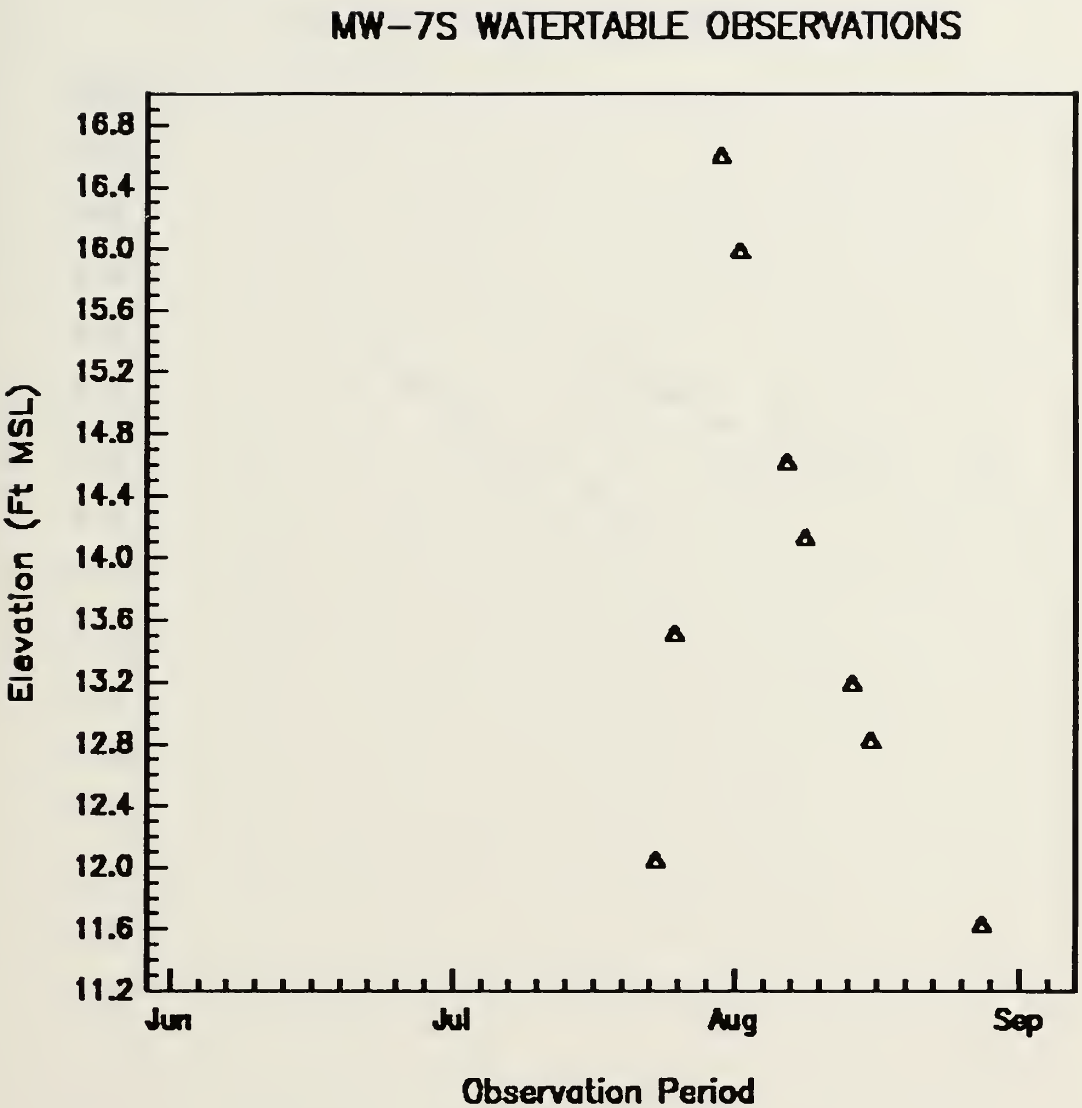

Figure 16. Water Level Observations - MW-7S, 8 June - 28 August 1990

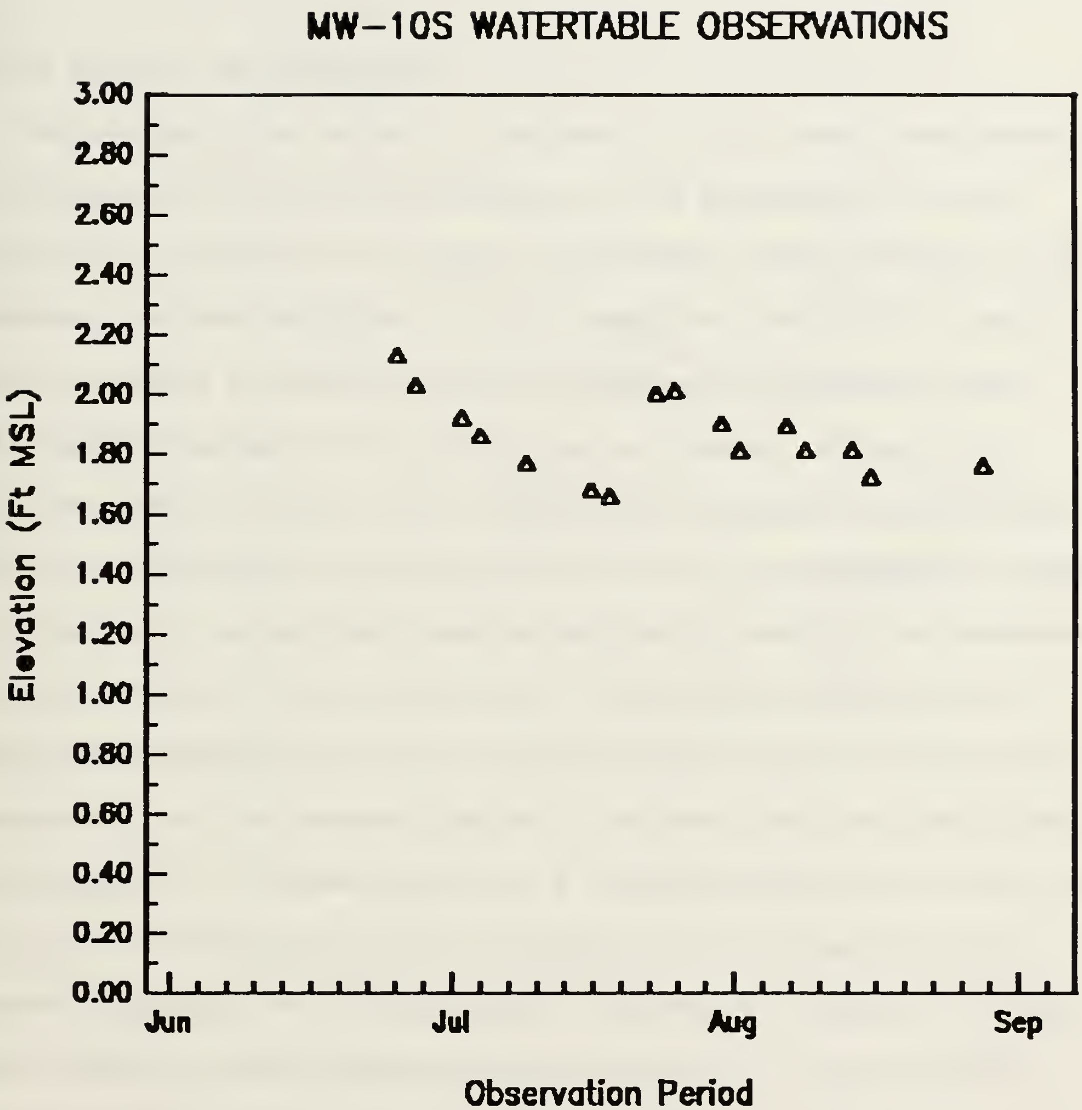

Figure 17. Water Level Observations - MW-10S, 8 June - 28 August 1990

4 feet. The boring log for MW-3S indicates well defined layers of top soil followed by sand/shale fragment mixture, each 24 inches thick. The increase in water level observed in MW-10 could be caused by tidal influence due to well's proximity to the bay.

Tidal Stress - Well Response

Monitoring of the wells at locations 1, 3, 5, 6 and 7 was conducted to determine the water table response of the groundwater at each location in relation to the tidal fluctuations. The evaluation of the response has been addressed in three categories, response in nested wells, response of bedrock wells and response in overburden wells. The response pattern for the nested wells, Figures (18) and (19) indicate that the bedrock wells experienced noticeable fluctuations while the overburden wells experienced little or no measurable response. At location 5, the aquifer layering provides a reduction of groundwater response between the two wells of 96%. The drastic differences in groundwater response, at this location, further serve to confirm the assumption that the bedrock aquifer is isolated from the upper aquifer and responds in a manner similar to a confined aquifer. The relationship of response between the wells at location 3 is also indicative of a separation of the two aquifer systems. However the attenuation of the tidal stress in MW-3D indicates that the aquifer is semi-confined, if not unconfined, with a highly impermeable layer providing separation from the open water.

All the bedrock wells (MW-1D, MW-3D and MW-5D) exhibited a noticeable response to tidal fluctuations. This response closely resembles the daily tidal cycle. Locations 1 and 5 exhibited response typical of

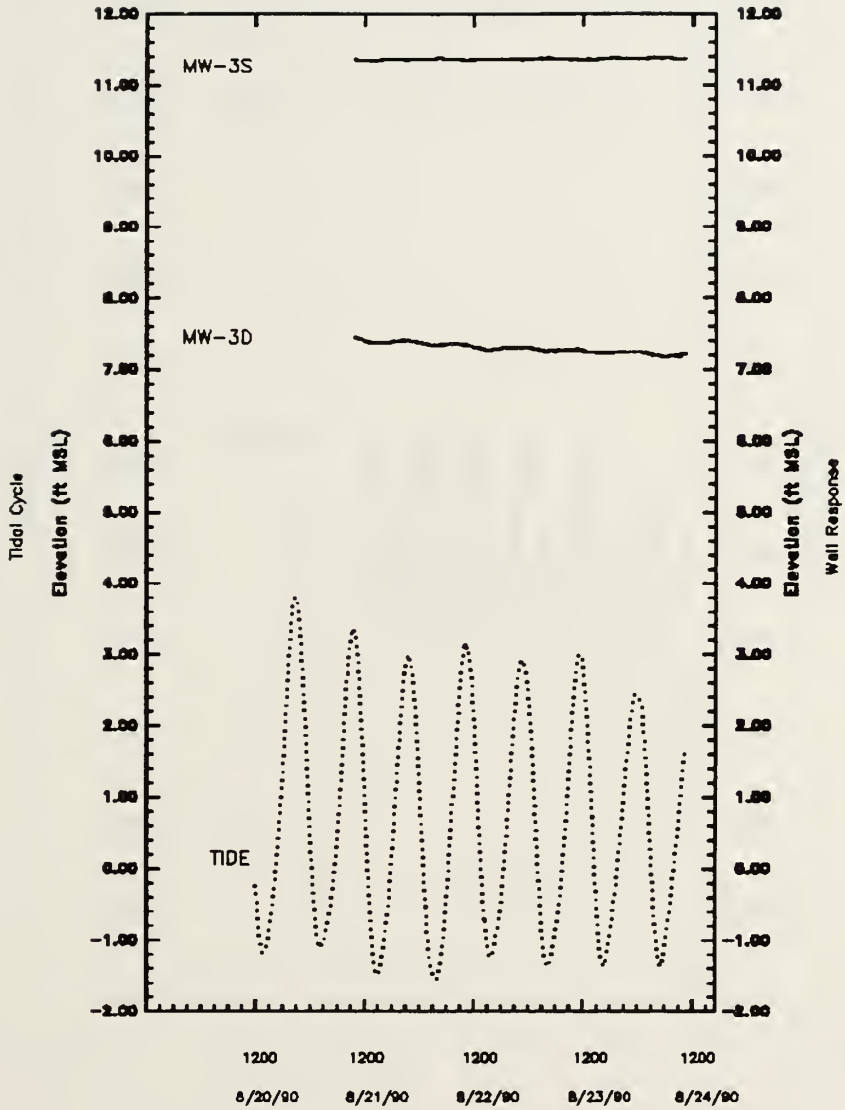

Figure 18. Well Response to Tidal Stress at Well Location 3

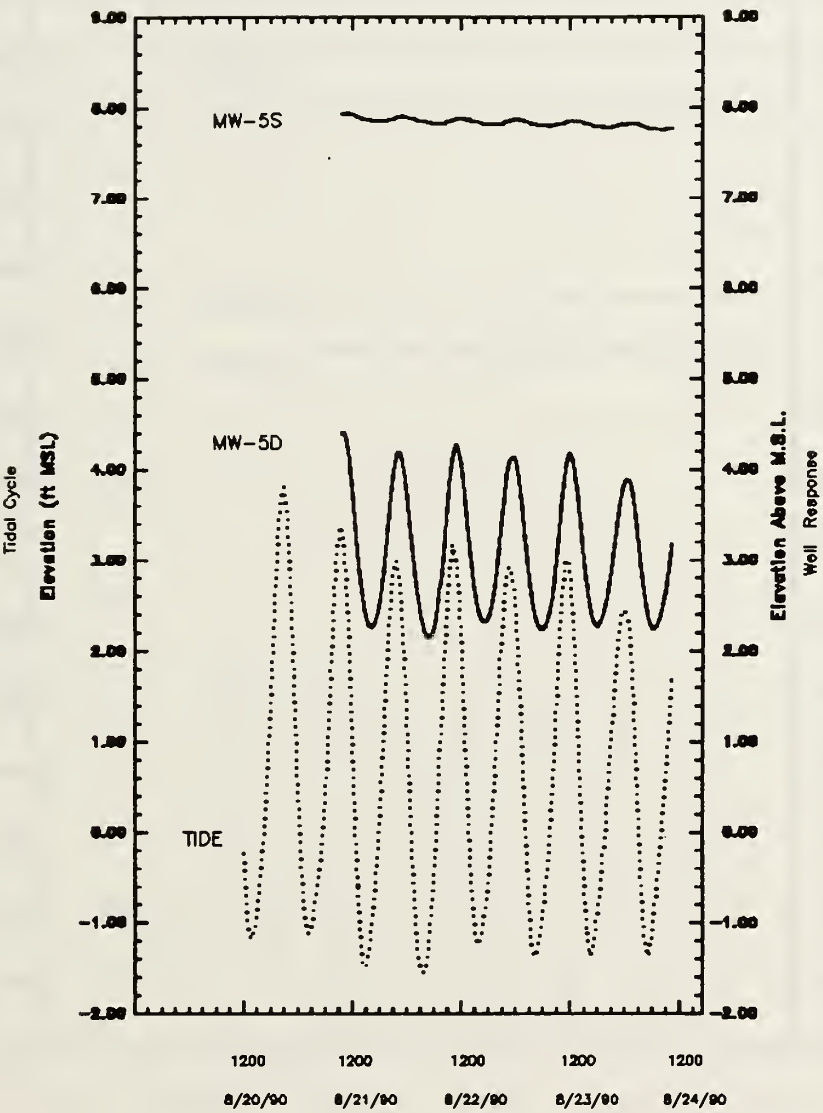

Figure 19. Well Response to Tidal Stress at Well Location 5

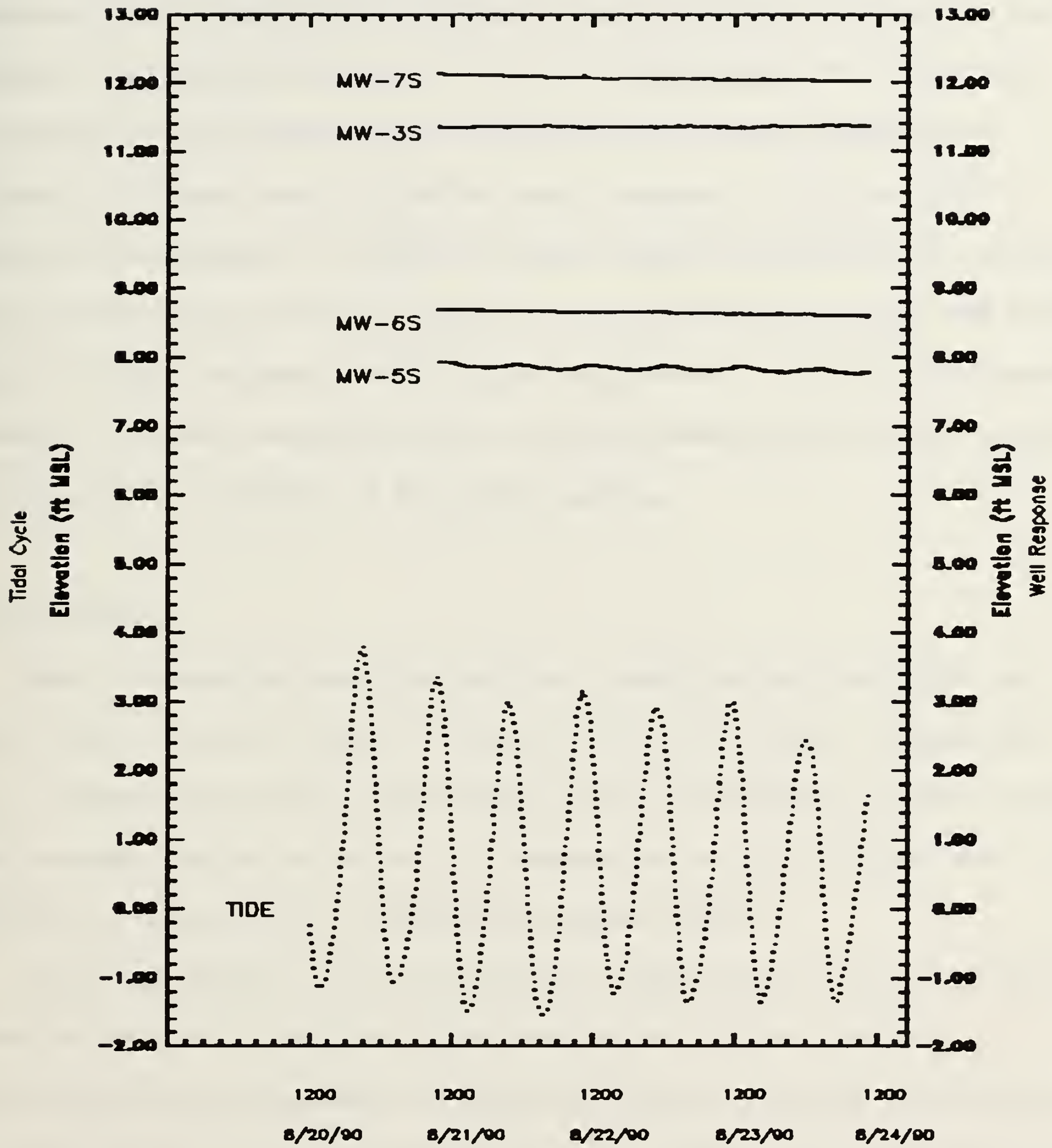

Figure 20. Shallow Well Response to Tidal Stress

confined to semi-confined aquifers while location 3 exhibited a response typical of a semi-confined to unconfined aquifer. Appendix (I) present observed well response-tidal stress diagrams for the each bedrock well. Response of the shallow wells to tidal stress appears to follow the long-wave fluctuations of the tidal cycle on a lunule month basis. Figure (20) shows that the shallow well response, while negligible, exhibited a decrease in elevation which could be indicative of long-wave fluctuation. The monitoring period was too short to determine the exact cycle of this response. However, the occurrence of this type of response seems to indicate that the underlying till material effectively provides an impermeable boundary to the upper aquifer.

Water Quality

Metals concentrations were used as a water quality indicator for this study. The metals that were used were lead, copper, mercury and zinc. These metals were chosen based on their conservative nature in the environment, potential toxicity to humans and marine life and the ability of marine life to concentrate these metals.

Basic groundwater quality parameters, temperature, pH, and specific conductivity, were measured using conventional meters. Table 5 summarizes these parameters at each well location. The pH was reported in the range of 6.1 - 7.5. These values are within the published range of values normally attributable to groundwater (Freeze & Cherry, 1979).

Specific conductivity can be used as a general indicator of water quality. Specific conductivity is a measurement of the water's ability to conduct electricity due to the presence of free electrons. These free electrons can be attributable to the dissociation of metal salts.

Table 5. Basic Groundwater Quality Measurements

Well No.	Temp (°C)	pH	Conductivity (μmhos)
1D	11	6.5	350
3D	12	6.1	550
3S	12	6.2	1310
4S	10	6.3	1000
5D	11	6.3	160
5S	11	6.2	450
10D	11	7.0	450
11D	11	7.5	400

Therefore, measurement of specific conductivity indicates the presence of possible contaminants. It does not however, give any indication of the type of contaminant. Drinking water can have a specific conductance as high as 1000 μmhos, provided the water does not contain harmful contaminants. Generally, however groundwater should exhibit a range of 0 - 300 μmhos. The range found in the monitoring wells (160 - 1310 μmhos) would indicate that some concentrations of undesirable materials were dissolved in the groundwater. The refuse wells exhibited a specific conductivity greater than 450 μmhos, indicating the presence of contaminants. MW-3S and MW-4S exhibited the highest specific conductivities, 1310 and 1000 μmhos respectively. This indicates that the central part of the landfill is where the majority of the contaminants are and that high concentrations should be expected.

Examination of the boring logs for the monitoring wells, shows that the landfill is generally comprised of two to four feet of cover material, four to thirty feet of refuse underlain by till up to eight feet in depth in combination with weathered shale and clay. Figure (21) provides a cross-sectional view of the landfill. It can be seen that as

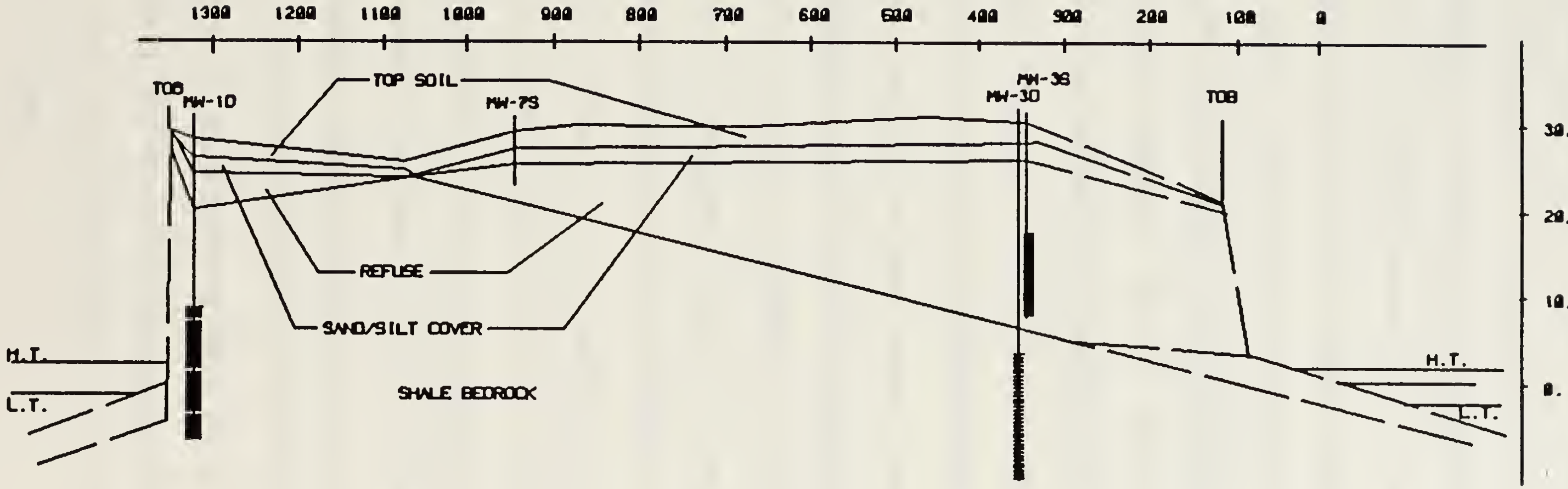

Figure 21. Cross-section of McAllister Point from MW-1D to MW-3D

the need arose to increase capacity, refuse was deposited in naturally occurring low areas. This pattern of operation provides a hydrologic unit that is very irregular in shape with unpredictable flow routes.

In those locations (ie. MW-5S/D) where till, in combination with clay and weathered shale, underlies the refuse, the concentration levels of metals detected in water samples from the deep wells was very low or not detectable. In those areas where the stratigraphy showed either till or weathered shale and clay (MW-3S/D, MW-10), the deep wells showed some elevated level of metals concentration, however, the levels were 2 - 3 orders of magnitude less than the surrounding shallow wells. Referring to Figure (22), it can be seen that the bedrock wells exhibited metals concentrations that were within the same order of magnitude or less than that found in the background well with the exception of copper concentrations in MW-1D. From this information it appears that the till material, singularly or in combination with clay and weathered shale, provide a semi-impermeable barrier to the migration of pollutants. Therefore the groundwater present in the bedrock wells is not viewed as a transport mechanism for the leachate from the landfill.

The background well, MW-11D, itself exhibited concentrations of lead copper and zinc that were in the range of 10^1 - 10^2 ppb. These values for these particular metals appear to be peculiar. MW-11D is located down gradient from a cemetery. This cemetery has been in existence for approximately 180 years. It is suspected that the burial practices followed by this cemetery has an influence on the background metals concentrations. Additional wells upgradient of the cemetery need to be installed to assess its impact.

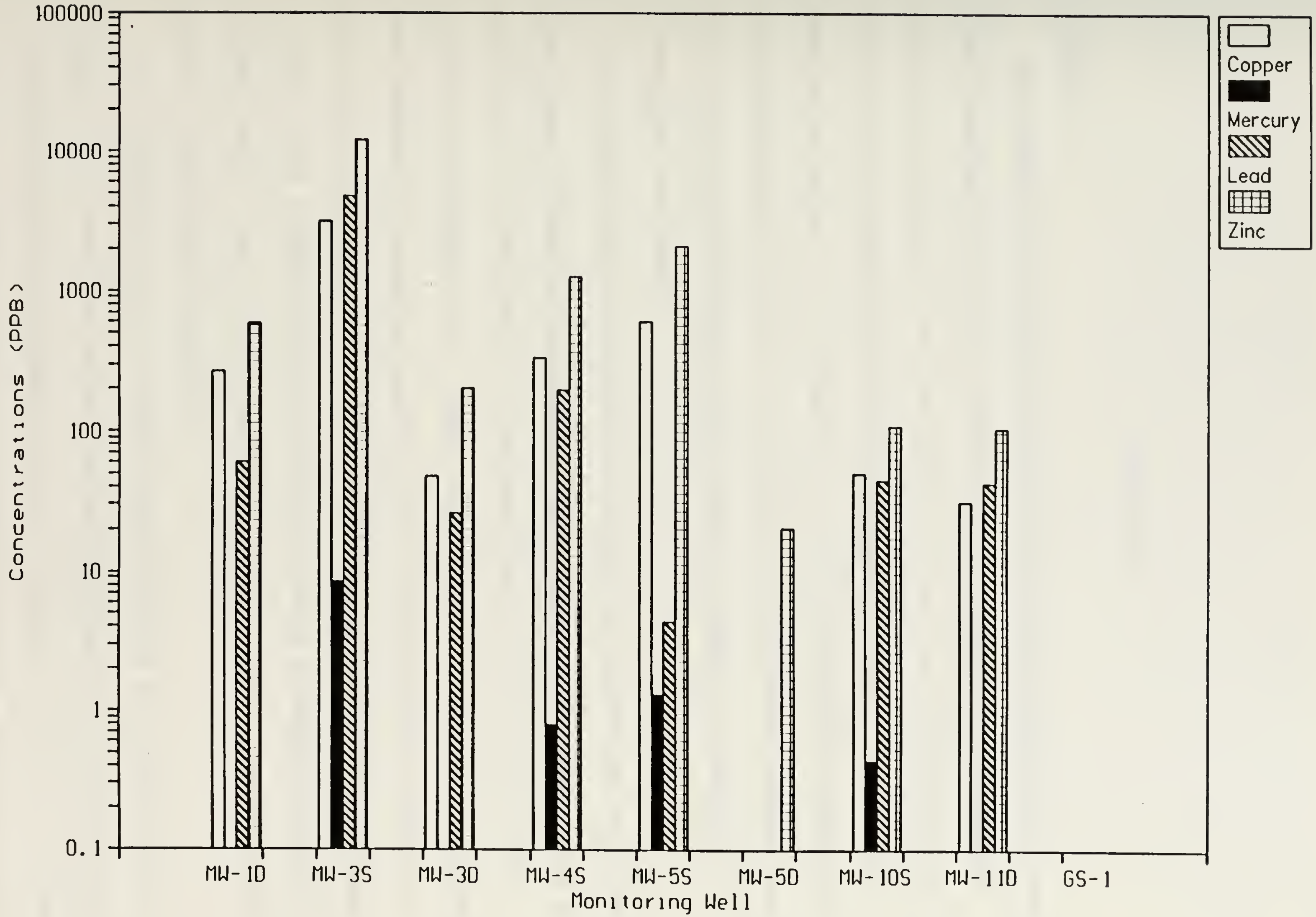

Figure 22. Concentrations of Copper, Lead, Mercury and Zinc in Groundwater Samples (February 1990)

MODELING

Concept

The modeling has been broken down into several subsections. Modeling input requirements are the recharge to the aquifer, the effective hydraulic conductivity of the aquifer system, the hydrogeology of the site and the boundary conditions. The model solution is intended to provide as output 1) the distribution of the freshwater seepage flux from the outflow face and 2) prediction of groundwater seepage quality. To evaluate the McAllister Point Landfill a number of modeling techniques were used.

The determination of aquifer recharge was assisted by using the Hydrologic Evaluation of Landfill Performance (HELP) model. This model predicted the percolation of leachate from the bottom layer of a landfill (Schroeder et al, 1984). An effective hydraulic conductivity was computed by adapting equations presented by Fetter (1980) for calculation of groundwater fluctuation in response to tidal stress. Seepage flux distribution was calculated using a method described by Urish (1987). Finally the groundwater seepage quality was evaluated using a mass-balance approach.

The seepage rate of a coastal aquifer varies as a function of the tidal cycle, occurring during the ebb tide from the mid-tide point to low tide. The actual seepage rate is a function of the head differential between the aquifer and the sea water. Thus when the tide is at its lowest the head differential is maximized and the seepage rate is

maximized. The rate decreases to near zero seepage at mid-tide and flow may reverse as high tide is approached. The following procedure outlined by Urish (1987) requires the calculation of the seepage face at the mid-tide point and then transforming the value to account for tidal influence.

The theoretical width of the seepage face, W_o, under static conditions, (Glover, 1959) is

$$W_o = -\frac{Q}{2\Delta\gamma K} \tag{2}$$

where

$\Delta\gamma$ is the density differential between freshwater and saltwater
Q is the total seepage flux
K is the hydraulic conductivity of the aquifer material

The value of W_o is then transformed to W_d by

$$W_d = W_o\left(\frac{K_v}{K_h}\right)^{\frac{1}{2}}$$

where

K_v is the hydraulic conductivity in the vertical direction
K_h is the hydraulic conductivity in the horizontal direction

This transformation accounts for the anisotropy and resultant increased outflow face width that has been observed by many researchers.

A pivot point on the surface of the phreatic aquifer is calculated, from which the hydraulic gradient is calculated during each time step of the ebb tide. This gradient is used to calculate the seepage flux

associated with that time step. The horizontal and vertical components of the pivot point location are given by (Todd, 1980)

$$X_p = \frac{-\ln \frac{h_x}{h_o}}{\left(\frac{\pi S}{\Delta\gamma T_t}\right)^{\frac{1}{2}}} \tag{4}$$

and

$$Y_p = \left[\frac{2\Delta\gamma Q X_p}{\frac{\pi S}{t_o K_t}}\right]^{\frac{1}{2}} \tag{5}$$

where

h_x is the observed groundwater fluctuation (L)
h_o is the tidal amplitude (L)
S is the specific yield
T_t is the transformed Transmissivity (L^2/T)
γ_f is the density of freshwater
$\Delta\gamma$ is the density differential between freshwater and saltwater

The gradient of the phreatic surface is given by the relation

$$I_o = \frac{Y_p}{X_p} \tag{6}$$

and the gradients throughout the ebb tide cycle can be computed as

$$I_t = \frac{Y_p + t\left(\frac{A}{n}\right)}{X_p + t\left(\frac{A}{n\tan\alpha}\right)} \tag{7}$$

where

A is the tidal amplitude
$\tan\alpha$ is the beach slope

t is the sequential time step number
n is the total number of time steps

The outflow quantity and the outflow face can be approximated by the following relationship of gradient

$$\frac{I_t}{I_o} = \frac{Q_t}{Q_o} = \frac{W_t}{W_o} \tag{8}$$

The seepage, q_t, can be determined for each time step by equation 9. The

$$q_t = \frac{Q_t}{W_t} \tag{9}$$

seepage is then weighted according to the time step proportion of the tide cycle. The values are summed to determine the total seepage during the ebb tide.

The procedure assumes a phreatic aquifer of homogeneous nature with the lower bound described by the freshwater-saltwater interface. It also assumes that the aquifer system is small with respect to head above mean sea level. Additional assumptions are that the flow in the system is predominately horizontal and that the basic groundwater requirements of Darcy's Law are satisfied. Application of the above technique to the McAllister Point landfill required a few adaptations described further herein.

Aquifer Recharge Determination

The HELP model (Schroeder, 1983) was used in the determination of the aquifer recharge. The landfill stratigraphy was defined for the model as shown in Figure (23). The model does not allow for groundwater flow through the landfill and assumes that the water table is below the

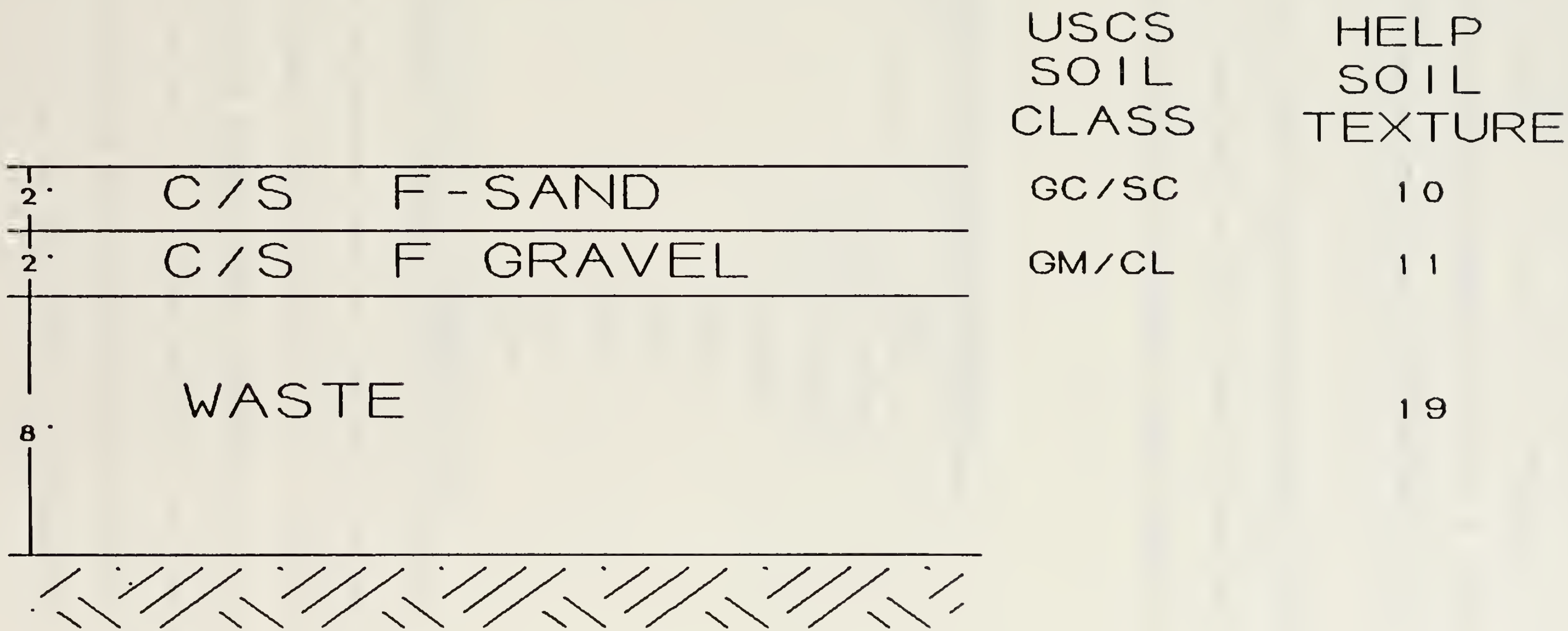

Figure 23. HELP Model Representation of Landfill Stratigraphy

landfill's bottom elevation. These assumptions make the model well suited, in this situation, to the role of predicting infiltration. The model was also used to predict percolation from a single layer system representative of the contributing watershed area outside of the landfill.

The parametric soil values used in the HELP model were the default values supplied by the model authors. These values are summarized in Table 6. A detailed listing of the HELP data files can be found in Appendix (D).

Table 6. HELP Model Soil Parameter Summary

Parameter	Value
K_1	0.5E-03 cm/day
K_2	0.6E-04 cm/day
K_3	1.9 cm/day
S_1	0.2443
S_2	0.3104
S_3	0.2942
W_{p1}	0.1361
W_{p2}	0.1875
W_{p3}	0.1400

K, S ans W_p are the hydraulic conductivity, storativity ans wilting point of each soil layer

The recharge was calculated based on the precipitation data for the 12 month period of November 1989 to October 1990. Precipitation records were obtained from the Newport Water Department for the Lawton Valley Reservoir. This reservoir is located within close proximity of the landfill and provides the most representative rainfall record for the area. The total recharge to the aquifer was determined as the sum of the infiltration quantity given by

$$Q_t = 0.014(I_l A_l + I_w A_w) \tag{10}$$

where:

I_l is the infiltration rate due to the landfill (L/T)
I_w is the infiltration rate from the contributing watershed (L/T)
A_l is the area of the landfill in acres (L^2)
A_w is the area of the contributing watershed in acres (L^2)

The HELP model predicted a value of 14.26 inches/year for the landfill and 14.28 inches/year for the remainder of the watershed. Substituting into equation (10) results in a total recharge rate of 0.095 cfs.

Beach Slope Calculations

The beach slope was calculated from data obtained from conventional field methods. Measurements of the beach face exposure were made from low tide to high tide. This provides a method to calculate the beach slope and associated outflow flow face for the associated tidal

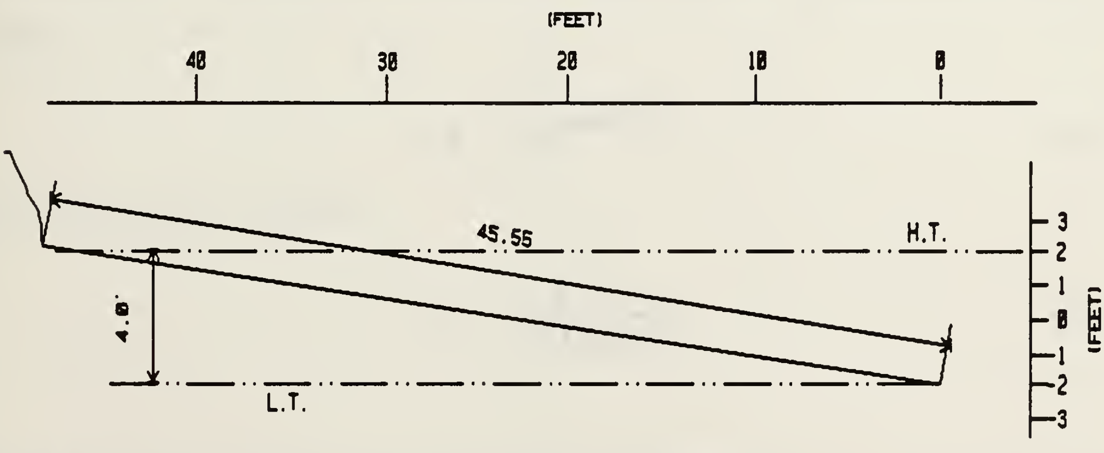

Figure 24. McAllister Point Beach Slope Geometry

amplitude. Figure (24) depicts the geometric relationship of the beach exposure face. Solving for the horizontal distance results in a distance of 44.88 feet, with a resultant slope of 0.08. Because the slope of the beach is shallow, the slope distance is approximately equal to the

horizontal distance. The percent difference between the two measurements is 0.15%. Therefore outflow face width can be considered approximately equal to the horizontal distance.

Effective Hydraulic Conductivity

The seepage flux calculation concept (Urish, 1987), previously discussed, makes use of the assumption of a homogeneous aquifer material. Figures (26) through (28) indicate that the landfill is composed of distinct layers of heterogeneous material. Each layer is highly variable in extent and thickness. Direct calculation of an average hydraulic conductivity is not possible, due to the lack of permeability data for the refuse material. Therefore, it will be necessary to back calculate an effective hydraulic conductivity which represents a homogeneous system capable of mimicking observed well fluctuations. Making use of the following equation presented by Fetter (1980)

$$H_x = H_o^{-x\sqrt{\pi S / t_o T}} \tag{11}$$

and solving for T gives

$$T = \frac{\pi S x^2}{t_o (\log H_x)^2} \tag{12}$$

This provides a value for an effective transmissivity. This value is then converted to effective hydraulic conductivity by dividing by the aquifer thickness. From Figure (29), the fluctuation of the groundwater at MW-5S can be found to be 0.08 feet and the tide range is 4.06 feet. The tidal cycle, the time required to go from one extreme to the other,

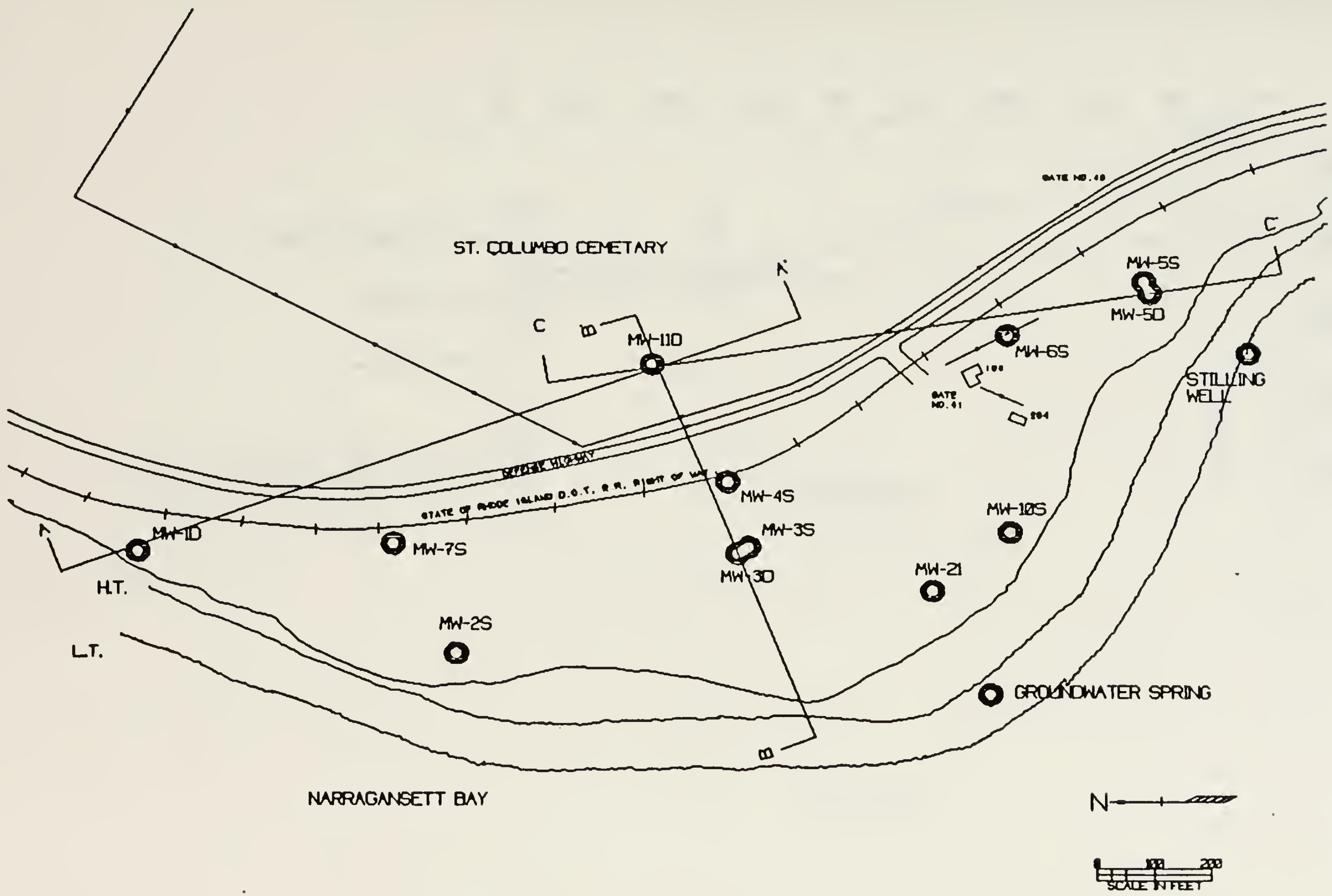

Figure 25. Location of Cross-sections at McAllister Point Landfill

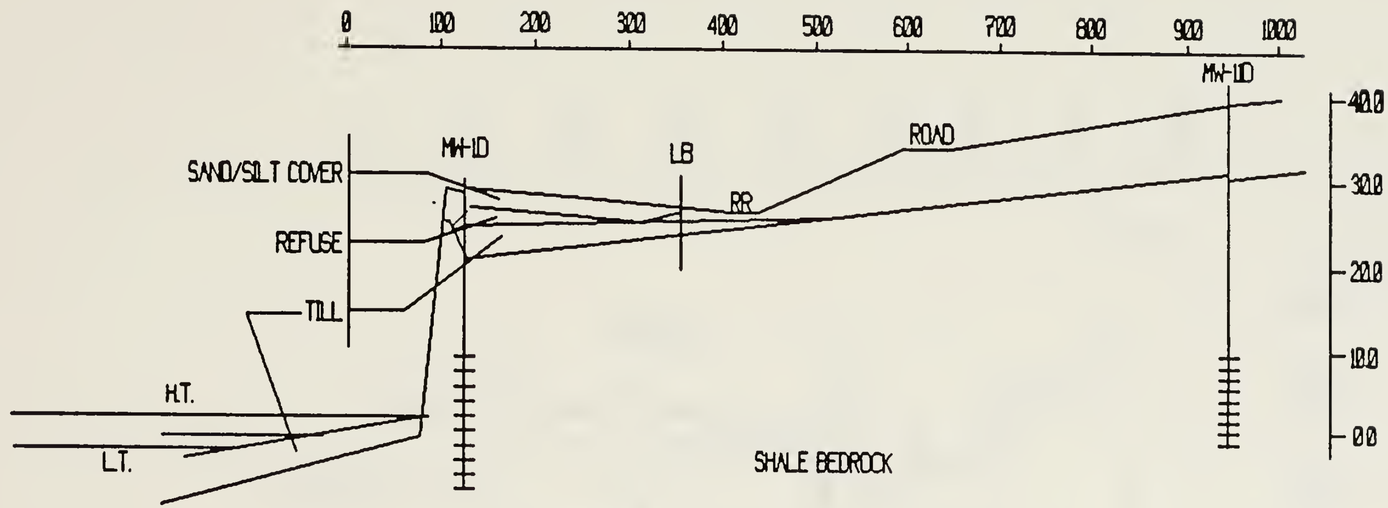

Figure 26. Cross-section from MW-1D to MW-11D (Section A-A')

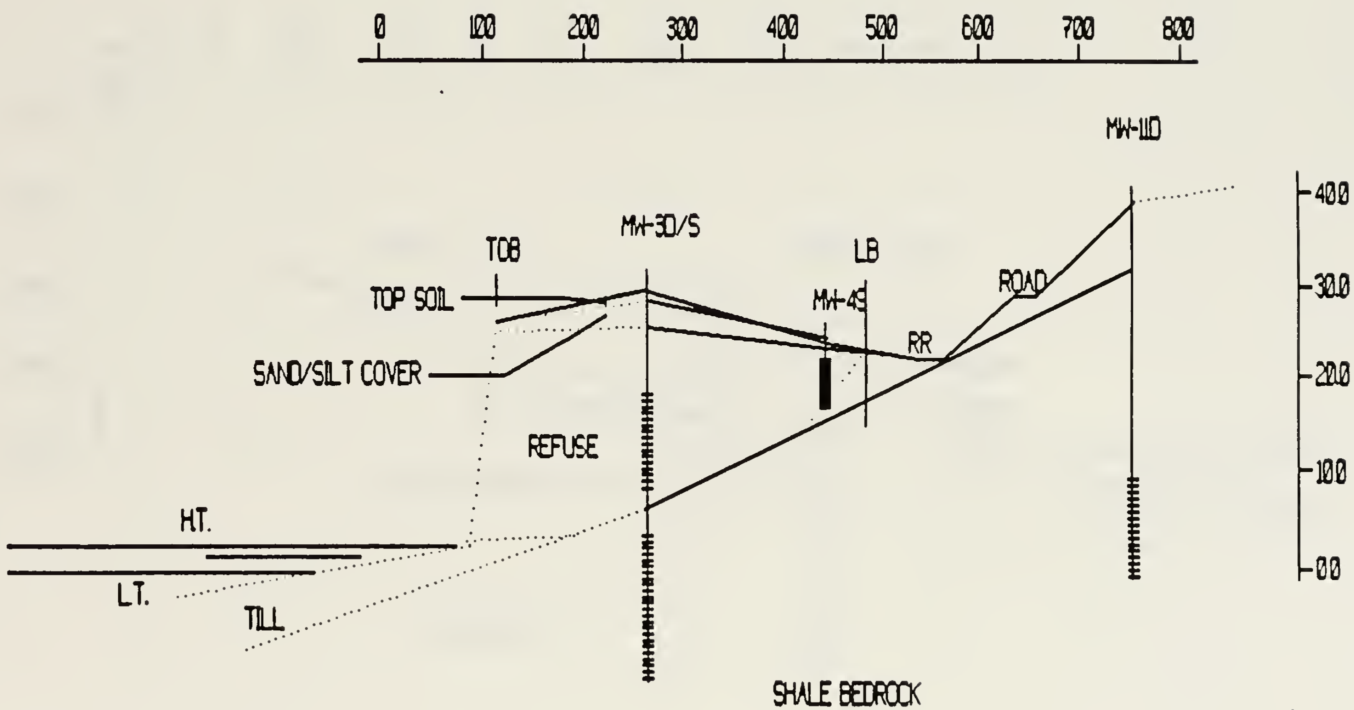

Figure 27. Cross-section from MW-3D/S to MW-11D (Section B-B')

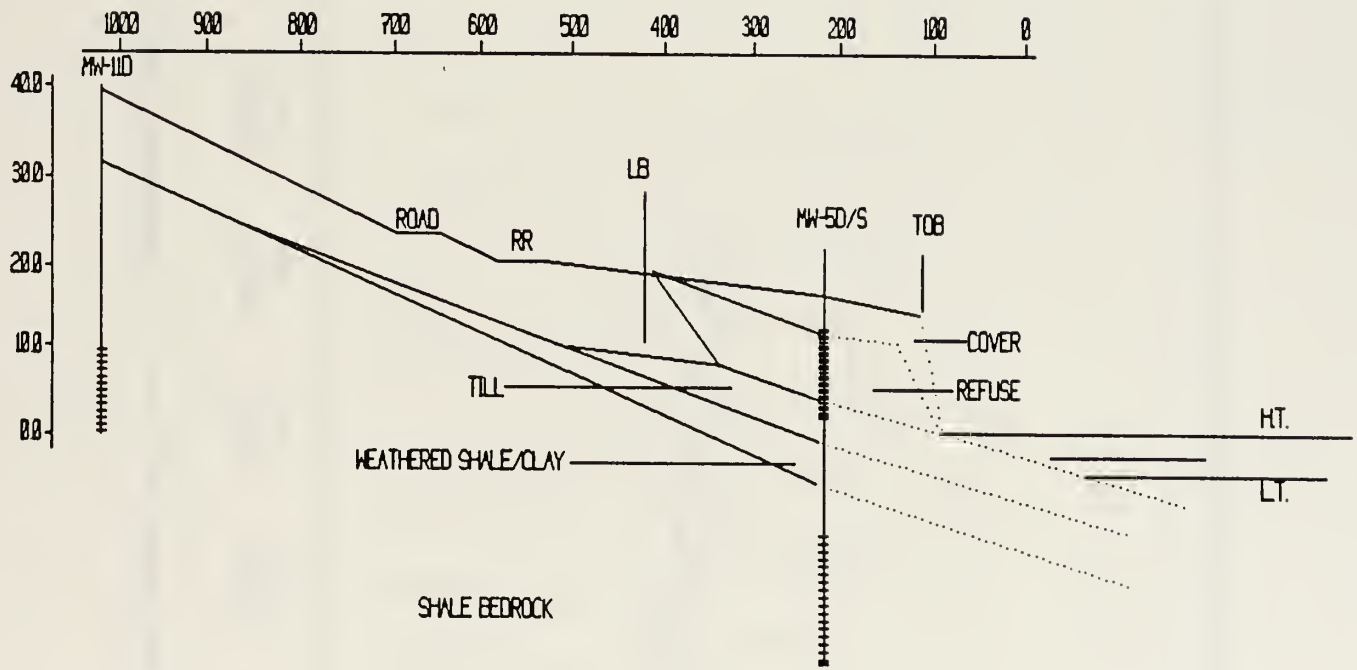

Figure 28. Cross-section from MW-11D to MW-5D/S (Section C-C')

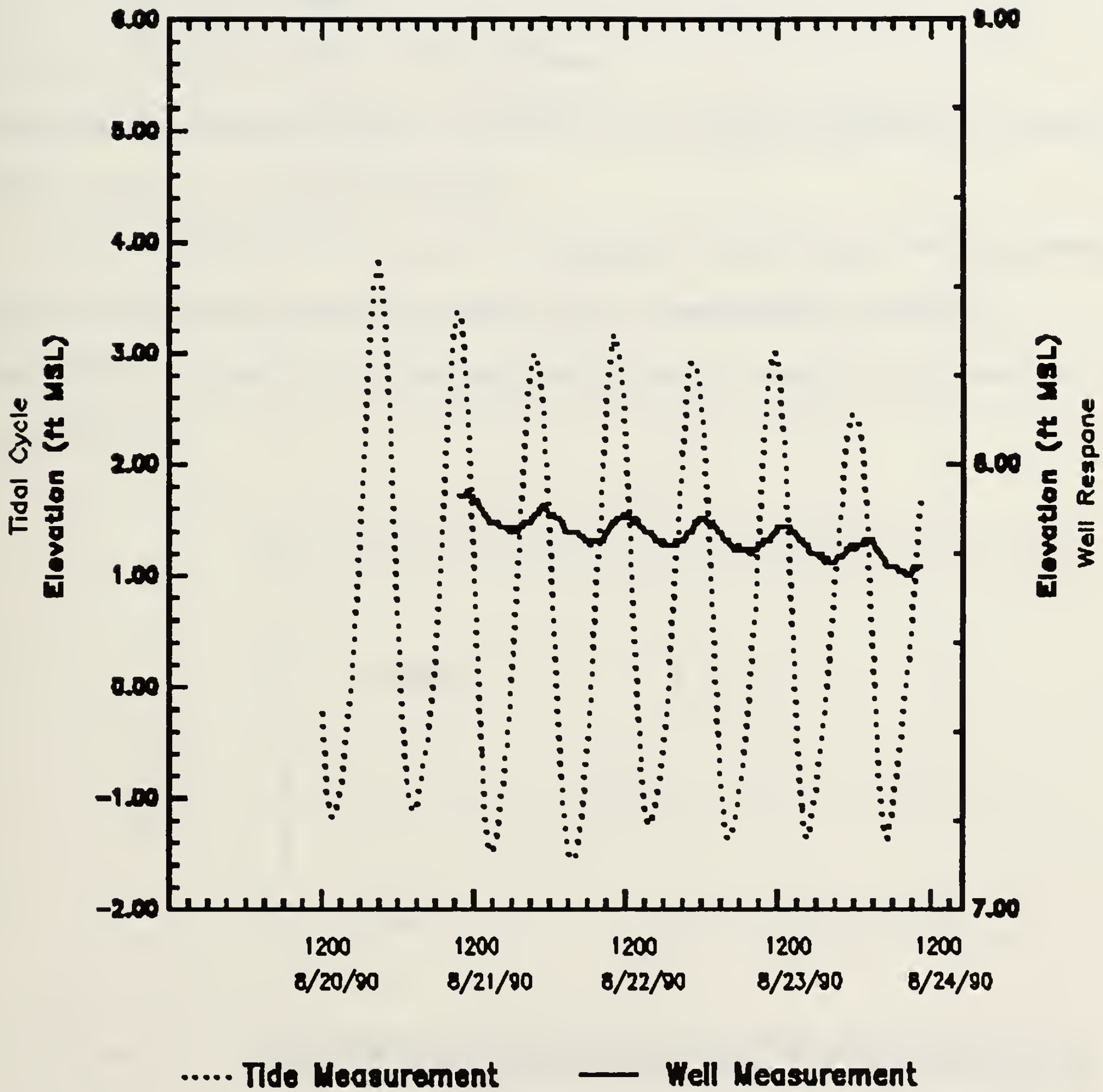

Figure 29. Tidal Stress on MW-5S, McAllister Point Landfill

is 6.5 hours. The distance, x, from MW-5S to the mean tide point is shown in Figure (25) and is found to be 150 feet. Substituting these values into equation (12) and assuming S = 0.2 yields a value for T of

$$T = \frac{\pi(0.2)(150)^2}{6.5(\log 0.08)^2}$$

$$T = 1.80E{+}03 \text{ ft}^2/\text{hr} = 0.50 \text{ ft}^2/\text{sec}$$

Assuming an average aquifer thickness of 16 feet as depicted in Figure (28), then K_{eff} = 3.13E-02 ft/sec.

An estimation for the value of hydraulic conductivity of the refuse can be obtained through the application of equivalent hydraulic conductivity theory. The representative aquifer system is presented in Figure (30).

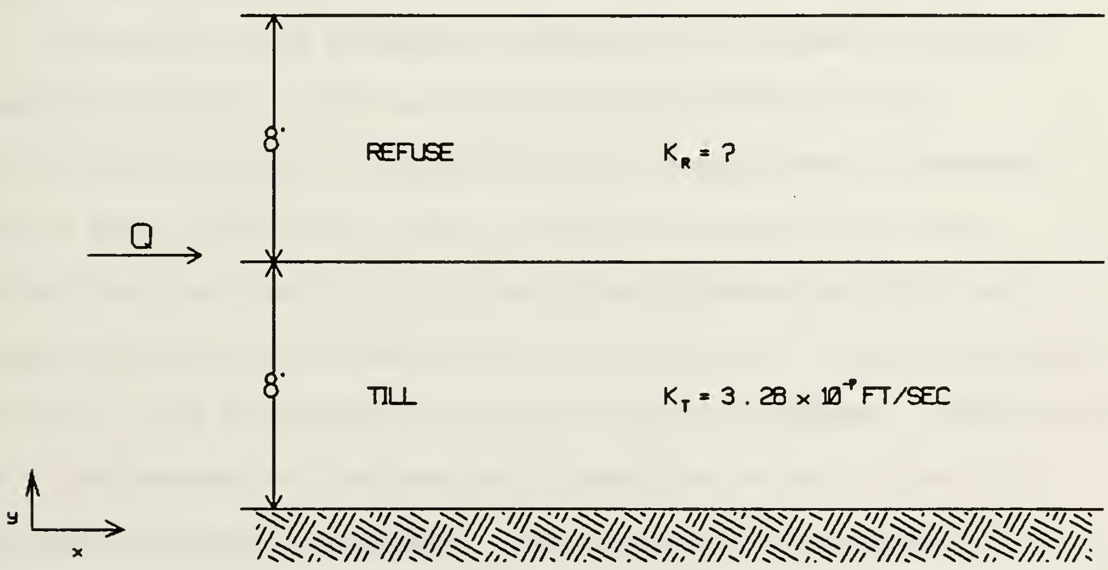

Figure 30. Representative Landfill Aquifer System

Determination of an equivalent hydraulic conductivity parallel to the layers is given by equation (13) (Freeze & Cherry, 1979). Accepted published values of hydraulic conductivity for glacial tills are in the

$$K_x = \frac{\sum_{i=1}^{n} K_i d_i}{d} \tag{13}$$

range of 10^{-6} to 10^{-12} ft/sec. Making the assumption that the principle direction of flow in the layered system is parallel to the layers and the K_{eff} calculated above is representative of that direction then

$$K_r = \frac{(K_{eff}*b) + (K_t*b_t)}{b_r} = \frac{3.13E\text{-}02(16) + 3.28E\text{-}07(8)}{8}$$

$$K_r = 6.25E\text{-}02 \text{ft/sec}$$

Considering the age of the landfill and the state of the material landfilled, the above values appear appropriate in this situation.

Seepage Flux Calculations

Calculation of the freshwater seepage flux followed the theory presented by Glover (1959) as adapted by Urish (1987). These calculations provided an estimation of the seepage from a submersed outflow face. This outflow face is assumed to begin at the tidal boundary and continue for an average fixed distance down the beach slope, for each time increment. The applicability of these calculations is based on the assumption of a sharp saltwater-freshwater interface and the transformation of the hydrologic properties of the aquifer to equivalent isotropic conditions. Calculations were performed to determine 1) the location of the groundwater pivot point and associated gradient for each time step, 2) the seepage flux per unit width of outflow face and 3) the weighted seepage flux for each time step.

The location of the phreatic surface pivot point varies with the observed watertable response to tidal stress. Therefore, calculation for

only one location, MW-5S, will be presented here, with a summary of the calculations for each near shore observation point contained in Appendix 13. The pivot point is calculated using Equations (4) and (5). From Figure (29), the appropriate values for h_x and h_o are 0.08 ft and 4.06 ft, respectively. From Figure 29, the mean aquifer thickness was determined as sixteen feet. Substituting the appropriate values into equations (4) and (5), yields

$$X_p = \frac{-\ln(0.08/4.06)}{[\pi(0.2)/(22500)(3.13E-02)]^{1/2}} = 379.22 \text{ ft}$$

and

$$Y_p = \left[\frac{2(0.025)(4.75E-05)(10.95)}{1.000 + (0.025)(0.50)}\right]^{1/2} = 0.030 \text{ ft}$$

The gradient at each time step can be calculated using equation (7). The outflow face at step 1 is then calculated by

$$W_1 = W_o \frac{I_1}{I_o} = 0.030 * (0.0014/0.0001) = 0.53 \text{ ft}$$

Similarly, the outflow can be calculated by

$$Q_1 = Q_o \frac{I_1}{I_o} = 4.75E-05 * (0.0014/0.0001) = 8.29E-04 \text{ cfs/ft}$$

and the seepage as

$$q_1 = \frac{Q_1}{W_1} = (8.29E-04)/(0.53) = 1.6E-03 \text{ cfs/sf}$$

The weighted time portion of time step one is 0.16, so the weighted seepage flux associated with time step one is

$$q_{1w} = q_1 * t_w = 1.6E-03 * 0.16 = 2.5E-04 \text{ cfs/sf}$$

The calculations for the remaining time steps are summarized in Table 7. The weighted seepages are then summed for the total seepage of 1.56E-03 cfs/sf.

Table 7. Seepage Calculation Summary for MW-5S

Step	I	W (feet)	Q (cfs/ft)	q (cfs/sf)	t_w (%)	q_w (cfs/sf)
0	0.0001	0.03	4.75E-05	1.56E-03	0.00	0.00E+00
1	0.0014	0.53	8.29E-04	1.56E-03	0.16	2.50E-04
2	0.0026	1.00	1.57E-03	1.56E-03	0.17	2.66E-04
3	0.0038	1.45	2.28E-03	1.56E-03	0.20	3.13E-04
4	0.0049	1.88	2.95E-03	1.56E-03	0.47	7.36E-04
					Total	1.56E-03

The above calcualtions assumes that a sharp saltwater-freshwater interface and static conditions exist. This theory provides an approximation of the submerged outflow width. Due to the existence of a transition zone between freshwater and saltwater and a moving tidal boundary, the actual outflow face would be much wider and less well defined.

Metals Concentration Decay Rate Predictions

The historical trend for MW-10S for lead and copper concentrations in groundwater samples is shown in Figures (31) and (32). These figures indicate a decline in the concentration level at this location over the past five years. In both cases, the concentration level was at or near the background level for that metal. Using this data, it can be inferred that the contaminant levels in MW-10S has declined 183.7 ppb/yr for lead and 192.6 ppb/yr for copper.

In the absence of historical data for the other monitoring wells, locations 1, 3, 4, 5, 6, and 7, and assuming that rate of contaminant

decline in the other wells is the same, then the landfill could continue to leach contaminants for up to 25 to 30 more years. Table 8 summarizes the anticipated time requirements for the lead and copper concentrations in the overburden wells to reach current background levels.

Table 8. Time Estimates for Contamination Decline in Overburden Wells

MW-3S		
Contaminant	Concentration (ppb)	Decline Time (years)
Lead	4800	26.2
Copper	3160	16.4

MW-4S		
Contaminant	Concentration (ppb)	Decline Time (years)
Lead	197	1.07
Copper	333	1.73

MW-5S		
Contaminant	Concentration (ppb)	Decline Time (years)
Lead	4.3 (<B.G.)	N/A
Copper	599	3.11

Only one bedrock well displayed contamination levels significantly above background levels. MW-1D displayed a level of copper contamination that was almost six times that found in the background well. Table 9 summarizes the estimated time requirement for contaminant levels in MW-1D to reach current background levels.

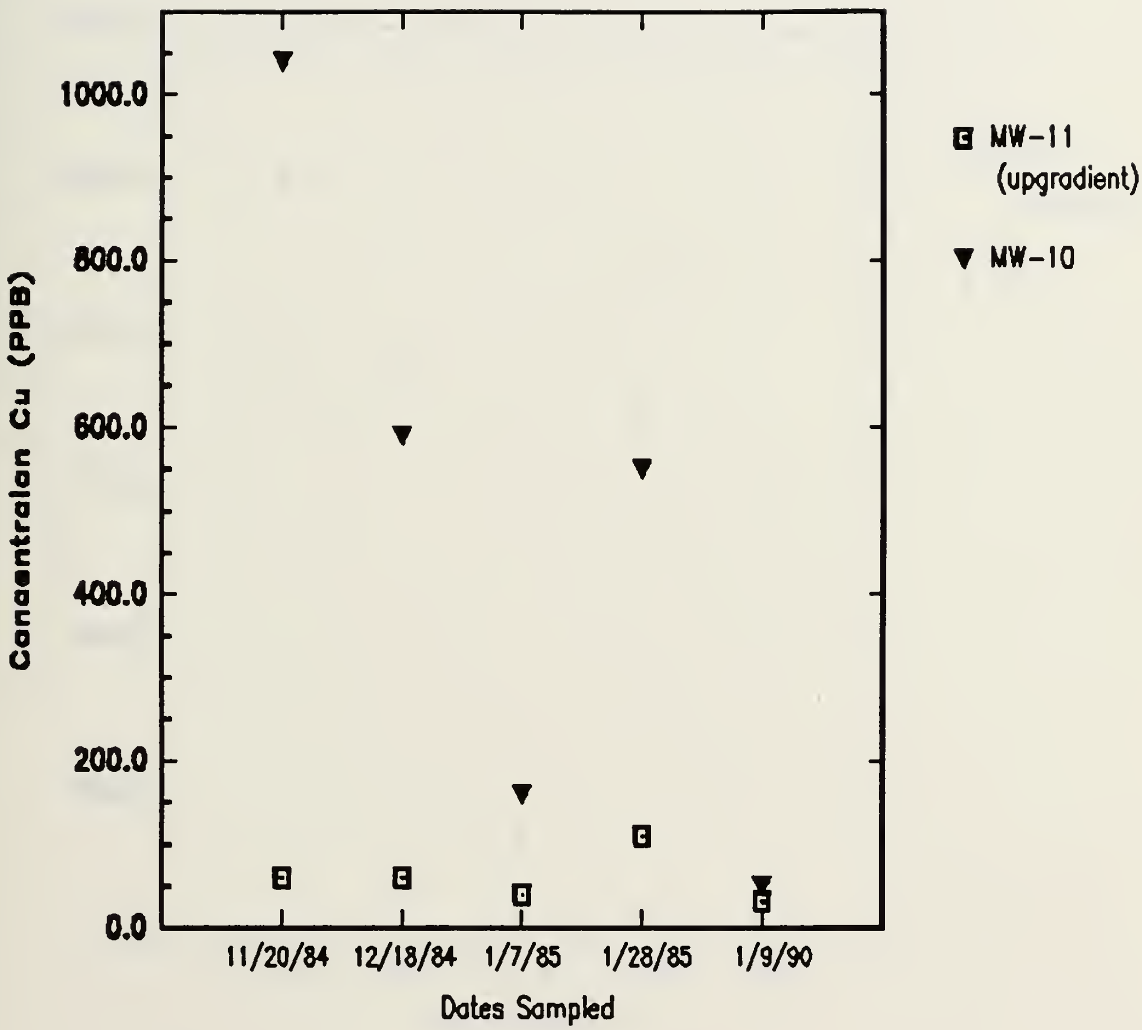

Figure 31. Groundwater Copper Concentrations, MW-10S and MW-11D, from Nov 1984 - Jan 1990

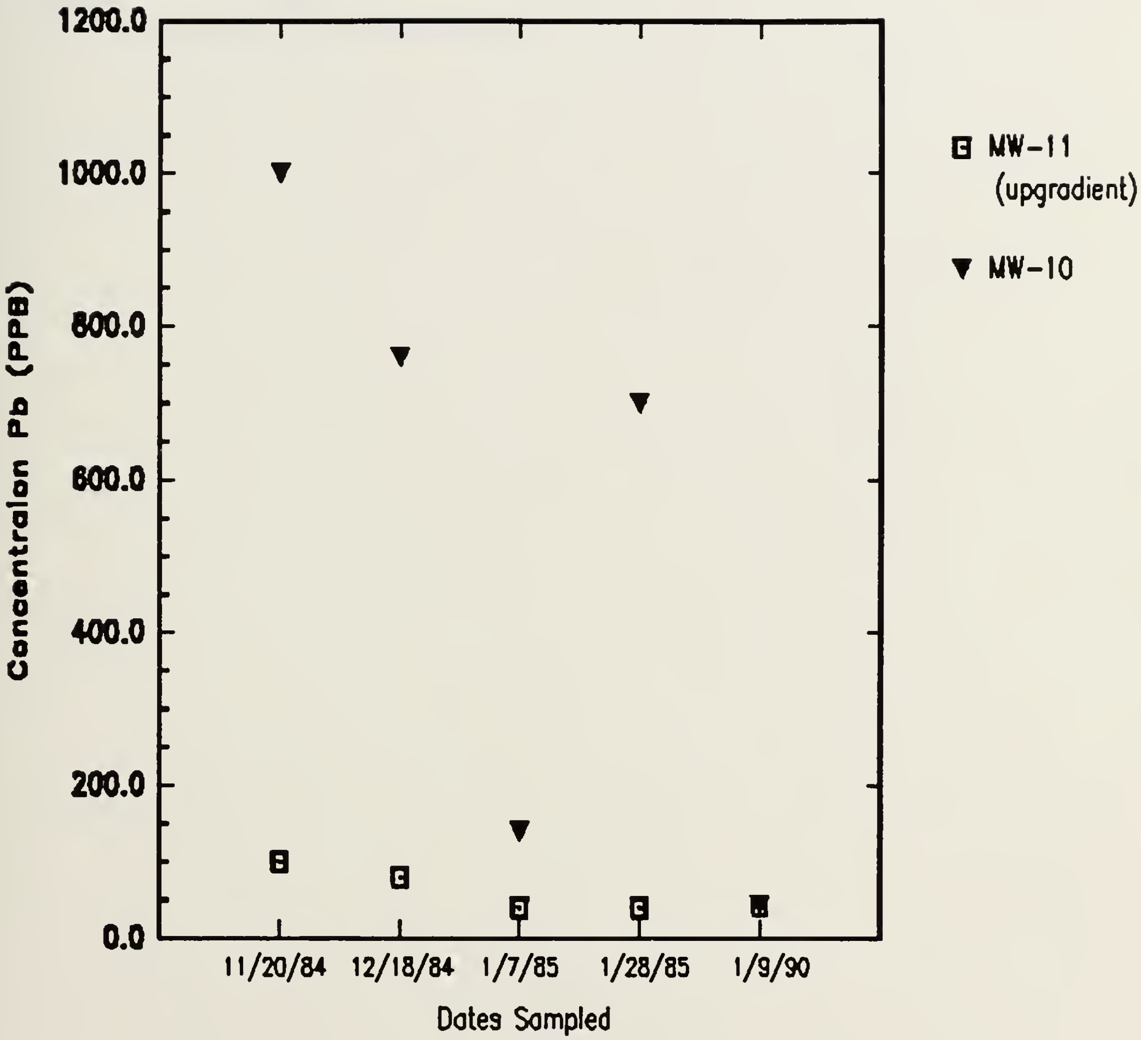

Figure 32. Groundwater Lead Concentrations, MW-10S and MW-11D, from Nov 1984 - Jan 1990

Table 9. Time Estimate for Contaminant Decline in Bedrock Well, MW-1D.

MW-1D		
Contaminant	Concentration (ppb)	Decline Time (years)
Lead	(<B.G.)	N/A
Copper	269	1.4

SUMMARY AND CONCLUSIONS

Groundwater seepage from the McAllister Point Landfill has been characterized as a function of tidal fluctuation. Freshwater seepage from the coastal aquifer occurs when the tide elevation is lower than the elevation of the aquifer pivot point. At McAllister Point, the height of the pivot point was computed as 0.03 feet above mid-tide. In this case, the height of the pivot point can be considered negligible, thus seepage of freshwater occurs approximately during the ebb tide from mid-tide to low tide. The theoretical, static submerged outflow width, under conditions of average annual recharge, was computed to vary from 0.53 to 1.88 feet. The actual total seepage face is the cumulative distance of the exposed beach slope plus the submerged outflow width. The maximum seepage face width, under average recharge and tidal conditions, is approximately 24.66 feet. The narrowest width occurs during the early portion of the seepage cycle. The seepage face width increases as low tide is approached and is maximized at low tide. The seepage rate at any given time step was calculated to remain constant at 1.56E-03 cfs/sf. The total seepage flux at a given time step varied as a function of outflow width and time step duration. The seepage period is equal to one quarter of the tidal cycle. For the average tidal cycle conditions at McAllister Point, seepage is estimated to occur for approximately 1.63 hours of each ebb tide. During the seepage period, it

was by modeling that 47% of the seepage emerges during the 46 minutes preceding low tide position.

This procedure offers a simple methodology that is easily employed to determine effective hydraulic conductivity, seepage rates and contaminant loading. It provides a time-dependent distribution of the seepage rate from the aquifer. This procedure can be used in combination with bio-accumulation studies to determine the impact that the contaminant loading of the seepage will have on marine life. Characterization of the seepage on a time-dependent basis provides a mechanism to better study and understand contaminant transport in the marine environment.

Characterization of the actual quantities of metals carried from the landfill was inconclusive. This was because the metals analysis of the groundwater seepage did not reveal detectable levels of lead, copper or mercury. Estimation of the leachate characteristics places the quantity of lead contained in the seepage at 34.37 pounds per year. The estimate for copper is 36.03 lbs per year.

Based on the extrapolation of historical data, the landfill can be expected to leach metals for approximately 30 more years. However the concentrations of metals of concern in the refuse wells, with one exception, should be at background levels within five years, without any mitigation actions.

Several areas require additional study for a better understanding of the coastal aquifer-tidal interface. These include 1) field measurement of the seepage quantities and locations, 2) characterization of the contribution of the cemetery to the groundwater metals concentrations, 3) long-term groundwater monitoring.

Measurement of seepage quantities and delineation of seepage locations would provide the required data to validate the procedures presented. Analysis of the seepage captured would provide a more accurate characterization of the leachate than was possible in this study.

It appears that the cemetery upgradient of MW-11D is making a significant contribution to the metals concentrations found in the groundwater. Additional wells upgradient from the cemetary are needed to determine the exact contribution. An investigation into past burial practices at the cemetery should be conducted in addtion to groundwater sampling.

Long-term monitoring is necessary to validate the prediction of metals concentration decline presented and gain a better understanding of the tidal stress-groundwater response relationship at this location. Long term-monitoring will enable the assessment of the affects of any remediation action that may be carried out at McAllister Point.

APPENDICES

APPENDIX A

Periodic Water Level Monitoring Data

MW - 1			ELEVATION		
			GL	MSL	MLW
		TEST PIPE	3.74	30.14	31.77
		APRON	0.00	28.03	29.66
GRID LOCATION		SCREEN	-20.00	8.03	9.66
	GRID LINE	WELL BOTT	-35.00	-6.97	-5.34
	OFFSET				

DATE MONITORED	DAYS FROM START	TIME	TOP OF WELL	WATER READING	DEPTH TO WATER	ELEVATION MSL	AVG ELEVATION
06/08/90	0	12:10	26.00	0.44	25.56	4.58	
06/08/90	0	16:56	26.50	0.78	25.72	4.42	4.50
06/12/90	4	09:51	26.00	0.31	25.69	4.45	
06/12/90	4	16:45	26.10	0.53	25.57	4.57	4.51
06/21/90	13	09:30	26.50	0.63	25.87	4.27	
06/21/90	13	14:51	26.50	0.37	26.13	4.01	4.14
06/26/90	18	10:45	26.60	0.39	26.21	3.93	
06/26/90	18	15:56	26.60	0.46	26.14	4.00	3.97
06/28/90	20	09:48	27.02	0.48	26.54	3.60	
06/28/90	20	15:58	27.00	0.70	26.30	3.84	3.72
07/03/90	25	09:52	27.00	0.46	26.54	3.60	
07/03/90	25	15:32	27.50	0.47	27.03	3.11	3.36
07/05/90	27	09:57	27.51	0.84	26.67	3.47	
07/05/90	27	16:05	27.50	0.65	26.85	3.29	3.38
07/10/90	32	09:52	27.50	0.62	26.88	3.26	
07/10/90	32	15:39	27.50	0.78	26.72	3.42	3.34
07/17/90	39	09:34	27.50	0.46	27.04	3.10	
07/17/90	39	15:43	27.50	0.38	27.12	3.02	3.06
07/19/90	41	09:40	27.50	0.60	26.90	3.24	
07/19/90	41	15:28	27.50	0.31	27.19	2.95	3.10
07/24/90	46	09:45	27.50	0.69	26.81	3.33	
07/24/90	46	15:37	27.50	0.95	26.55	3.59	3.46
07/26/90	48	09:59	27.50	0.66	26.84	3.30	
07/26/90	48	15:34	27.50	1.05	26.45	3.69	3.50
07/31/90	53	09:55	26.50	0.86	25.64	4.50	
07/31/90	53	15:34	26.50	0.91	25.59	4.55	4.53
08/02/90	55	09:41	26.50	0.84	25.66	4.48	
08/02/90	55	16:10	26.50	0.79	25.71	4.43	4.46
08/07/90	60	09:49	26.50	0.52	25.98	4.16	
08/07/90	60	15:40	26.50	0.46	26.04	4.10	4.13
08/09/90	62	09:38	27.00	0.44	26.56	3.58	
08/09/90	62	15:47	27.01	0.88	26.13	4.01	3.80
08/14/90	67	09:33	27.06	0.45	26.61	3.53	
08/14/90	67	15:46	27.20	0.72	26.48	3.66	3.60
08/16/90	69	09:45	27.40	0.72	26.68	3.46	
08/16/90	69	15:53	27.50	0.65	26.85	3.29	3.38
08/28/90	81	09:51	28.00	0.81	27.19	2.95	
08/28/90	81	15:35	28.00	0.99	27.01	3.13	3.04

MW - 3D

		ELEVATION		
		GL	MSL	MLW
	TEST PIPE	2.52	32.65	34.28
	APRON	0.00	30.13	31.76
GRID LOCATION	SCREEN	-27.00	3.13	4.76
GRID LINE	WELL BOTT	-42.00	-11.87	-10.24
OFFSET				

DATE MONITORED	DAYS FROM START	TIME	TOP OF WELL	WATER READING	DEPTH TO WATER	ELEVATION MSL	AVG ELEVATION
06/08/90	0	11:47	23.50	0.59	22.91	9.74	
06/08/90	0	16:29	23.50	0.63	22.87	9.78	9.76
06/12/90	4	09:26	23.50	0.46	23.04	9.61	
06/12/90	4	16:24	23.50	0.42	23.08	9.57	9.59
06/21/90	13	09:15	24.00	0.65	23.35	9.30	
06/21/90	13	14:28	24.00	0.63	23.37	9.28	9.29
06/26/90	18	10:27	24.00	0.47	23.53	9.12	
06/26/90	18	15:43	24.00	0.44	23.56	9.09	9.11
06/28/90	20	09:29	24.00	0.39	23.61	9.04	
06/28/90	20	15:41	24.01	0.41	23.60	9.05	9.04
07/03/90	25	09:34	24.50	0.74	23.76	8.89	
07/03/90	25	15:14	24.50	0.74	23.76	8.89	8.89
07/05/90	27	09:35	24.50	0.72	23.78	8.87	
07/05/90	27	15:46	24.50	0.71	23.79	8.86	8.87
07/10/90	32	09:30	24.50	0.62	23.88	8.77	
07/10/90	32	15:22	24.50	0.57	23.93	8.72	8.75
07/17/90	39	09:16	24.50	0.37	24.13	8.52	
07/17/90	39	15:27	24.50	0.42	24.08	8.57	8.55
07/19/90	41	09:24	25.00	0.85	24.15	8.50	
07/19/90	41	15:20	25.00	0.89	24.11	8.54	8.52
07/24/90	46	09:25	25.00	0.79	24.21	8.44	
07/24/90	46	15:25	25.00	0.74	24.26	8.39	8.41
07/26/90	48	09:37	25.00	0.72	24.28	8.37	
07/26/90	48	15:21	25.00	0.71	24.29	8.36	8.37
07/31/90	53	09:32	24.50	0.77	23.73	8.92	
07/31/90	53	15:21	24.50	0.58	23.92	8.73	8.82
08/02/90	55	09:28	24.50	0.50	24.00	8.65	
08/02/90	55	15:58	24.50	0.53	23.97	8.68	8.67
08/07/90	60	09:29	24.50	0.48	24.02	8.63	
08/07/90	60	15:25	24.50	0.41	24.09	8.56	8.60
08/09/90	62	09:21	24.50	0.39	24.11	8.54	
08/09/90	62	15:35	25.00	0.86	24.14	8.51	8.53
08/14/90	67	09:20	25.00	0.72	24.28	8.37	
08/14/90	67	15:36	25.00	0.77	24.23	8.42	8.39
08/16/90	69	09:34	25.00	0.64	24.36	8.29	
08/16/90	69	15:45	25.00	0.67	24.33	8.32	8.31
08/28/90	81	09:40	25.00	0.33	24.67	7.98	
08/28/90	81	15:26	25.00	0.33	24.67	7.98	7.98

MW - 3S				ELEVATION	
			GL	MSL	MLW
		TEST PIPE	2.45	32.41	34.04
		APRON	0.00	29.96	31.59
GRID LOCATION		SCREEN	-12.50	17.46	19.09
	GRID LINE	WELL BOTT	-22.50	7.46	9.09
	OFFSET				

DATE MONITORED	DAYS FROM START	TIME	TOP OF WELL	WATER READING	DEPTH TO WATER	ELEVATION MSL	AVG ELEVATION
06/08/90	0	11:38	21.00	0.40	20.60	11.81	
06/08/90	0	16:25	21.00	0.45	20.55	11.86	11.83
06/12/90	4	09:23	21.50	0.88	20.62	11.79	
06/12/90	4	16:21	21.00	0.39	20.61	11.80	11.79
06/21/90	13	09:12	21.00	0.33	20.67	11.74	
06/21/90	13	14:26	21.00	0.36	20.64	11.77	11.75
06/26/90	18	10:25	21.00	0.30	20.70	11.71	
06/26/90	18	15:40	21.00	0.32	20.68	11.73	11.72
06/28/90	20	09:27	21.00	0.30	20.70	11.71	
06/28/90	20	15:40	21.00	0.31	20.69	11.72	11.71
07/03/90	25	09:30	21.50	0.78	20.72	11.69	
07/03/90	25	15:10	21.50	0.78	20.72	11.69	11.69
07/05/90	27	09:32	21.51	0.78	20.73	11.68	
07/05/90	27	15:42	21.50	0.77	20.73	11.68	11.68
07/10/90	32	09:28	21.60	0.82	20.78	11.63	
07/10/90	32	15:19	21.50	0.73	20.77	11.64	11.63
07/17/90	39	09:13	21.50	0.62	20.88	11.53	
07/17/90	39	15:23	21.50	0.64	20.86	11.55	11.54
07/19/90	41	09:19	21.50	0.63	20.87	11.54	
07/19/90	41	15:17	21.50	0.65	20.85	11.56	11.55
07/24/90	46	09:22	21.50	0.60	20.90	11.51	
07/24/90	46	15:27	21.50	0.59	20.91	11.50	11.50
07/26/90	48	09:33	21.50	0.55	20.95	11.46	
07/26/90	48	15:18	21.50	0.55	20.95	11.46	11.46
07/31/90	53	09:30	21.50	0.58	20.92	11.49	
07/31/90	53	15:19	21.50	0.59	20.91	11.50	11.49
08/02/90	55	09:26	21.50	0.52	20.98	11.43	
08/02/90	55	15:55	21.50	0.52	20.98	11.43	11.43
08/07/90	60	09:26	21.50	0.54	20.96	11.45	
08/07/90	60	15:23	21.50	0.54	20.96	11.45	11.45
08/09/90	62	09:18	21.50	0.53	20.97	11.44	
08/09/90	62	15:33	21.50	0.54	20.96	11.45	11.44
08/14/90	67	09:18	21.50	0.51	20.99	11.42	
08/14/90	67	15:33	21.50	0.52	20.98	11.43	11.42
08/16/90	69	09:31	21.50	0.50	21.00	11.41	
08/16/90	69	15:42	21.50	0.55	20.95	11.46	11.44
08/28/90	81	09:37	22.00	0.94	21.06	11.35	
08/28/90	81	15:24	22.00	0.97	21.03	11.38	11.36

MW - 5D		ELEVATION GL	MSL	MLW
	TEST PIPE	2.48	18.94	20.57
	APRON	0.00	16.46	18.09
GRID LOCATION	SCREEN	-27.50	-11.04	-9.41
GRID LINE	WELL BOTT	-42.50	-26.04	-24.41
OFFSET				

DATE MONITORED	DAYS FROM START	TIME START	TOP OF WELL	WATER READING	DEPTH TO WATER	ELEVATION MSL	AVG ELEVATION
06/08/90	0	11:24	16.00	0.53	15.47	3.47	
06/08/90	0	16:17	16.50	0.31	16.19	2.75	3.11
06/12/90	4	09:14	16.40	1.08	15.32	3.62	
06/12/90	4	15:58	16.55	0.75	15.80	3.14	3.38
06/21/90	13	08:58	16.01	0.99	15.02	3.92	
06/21/90	13	14:18	17.00	0.52	16.48	2.46	3.19
06/26/90	18	10:06	16.00	0.56	15.44	3.50	
06/26/90	18	15:27	16.50	0.53	15.97	2.97	3.24
06/28/90	20	09:15	17.00	0.56	16.44	2.50	
06/28/90	20	15:27	16.00	0.79	15.21	3.73	3.12
07/03/90	25	09:14	17.00	1.03	15.97	2.97	
07/03/90	25	14:58	16.50	0.75	15.75	3.19	3.08
07/05/90	27	09:19	16.50	0.92	15.58	3.36	
07/05/90	27	15:31	16.50	0.45	16.05	2.89	3.13
07/10/90	32	09:10	16.50	1.01	15.49	3.45	
07/10/90	32	15:09	17.01	0.48	16.53	2.41	2.93
07/17/90	39	09:01	17.50	0.74	16.76	2.18	
07/17/90	39	15:11	16.10	0.78	15.32	3.62	2.90
07/19/90	41	09:08	16.50	0.43	16.07	2.87	
07/19/90	41	15:06	16.60	0.32	16.28	2.66	2.77
07/24/90	46	09:03	16.00	0.78	15.22	3.72	
07/24/90	46	15:07	17.00	0.61	16.39	2.55	3.14
07/26/90	48	09:08	16.50	0.36	16.14	2.80	
07/26/90	48	15:05	16.50	0.84	15.66	3.28	3.04
07/31/90	53	09:12	16.50	0.30	16.20	2.74	
07/31/90	53	15:07	16.05	1.01	15.04	3.90	3.32
08/02/90	55	09:10	16.50	0.53	15.97	2.97	
08/02/90	55	15:24	16.50	0.71	15.79	3.15	3.06
08/07/90	60	09:12	15.50	0.72	14.78	4.16	
08/07/90	60	15:11	17.10	0.51	16.59	2.35	3.26
08/09/90	62	09:04	16.00	0.57	15.43	3.51	
08/09/90	62	15:20	16.90	0.47	16.43	2.51	3.01
08/14/90	67	09:04	17.00	0.36	16.64	2.30	
08/14/90	67	15:18	15.50	0.64	14.86	4.08	3.19
08/16/90	69	09:18	17.00	0.54	16.46	2.48	
08/16/90	69	15:28	16.60	1.06	15.54	3.40	2.94
08/28/90	81	09:24	17.00	0.76	16.24	2.70	
08/28/90	81	15:12	15.50	0.43	15.07	3.87	3.29

MW - 5S		ELEVATION		
		GL	MSL	MLW
	TEST PIPE	2.57	18.69	20.32
	APRON	0.00	16.12	17.75
GRID LOCATION	SCREEN	-4.00	12.12	13.75
GRID LINE	WELL BOTT	-14.00	2.12	3.75
OFFSET				

DATE MONITORED	DAYS FROM START	TIME	TOP OF WELL	WATER READING	DEPTH TO WATER	ELEVATION MSL	AVG ELEVATION
06/08/90	0	11:19	10.10	0.90	9.20	9.49	
06/08/90	0	16:13	10.00	0.84	9.16	9.53	9.51
06/12/90	4	09:12	10.00	0.65	9.35	9.34	
06/12/90	4	15:52	10.00	0.66	9.34	9.35	9.35
06/21/90	13	08:53	10.20	0.50	9.70	8.99	
06/21/90	13	14:11	10.80	1.04	9.76	8.93	8.96
06/26/90	18	10:04	11.20	1.26	9.94	8.75	
06/26/90	18	15:24	10.50	0.58	9.92	8.77	8.76
06/28/90	20	09:12	10.50	0.44	10.06	8.63	
06/28/90	20	15:24	10.50	0.51	9.99	8.70	8.67
07/03/90	25	09:11	10.70	0.52	10.18	8.51	
07/03/90	25	14:56	10.70	0.52	10.18	8.51	8.51
07/05/90	27	09:16	11.11	0.85	10.26	8.43	
07/05/90	27	15:27	11.20	0.89	10.31	8.38	8.41
07/10/90	32	09:08	11.20	0.73	10.47	8.22	
07/10/90	32	15:03	11.10	0.63	10.47	8.22	8.22
07/17/90	39	08:58	11.00	0.37	10.63	8.06	
07/17/90	39	15:08	11.50	0.92	10.58	8.11	8.09
07/19/90	41	09:04	11.00	0.35	10.65	8.04	
07/19/90	41	15:03	11.01	0.36	10.65	8.04	8.04
07/24/90	46	08:53	11.50	0.77	10.73	7.96	
07/24/90	46	15:04	11.52	0.79	10.73	7.96	7.96
07/26/90	48	09:05	10.60	0.43	10.17	8.52	
07/26/90	48	15:02	11.00	0.88	10.12	8.57	8.55
07/31/90	53	09:07	10.50	0.53	9.97	8.72	
07/31/90	53	15:03	10.50	0.55	9.95	8.74	8.73
08/02/90	55	09:06	10.70	0.53	10.17	8.52	
08/02/90	55	15:14	10.60	0.43	10.17	8.52	8.52
08/07/90	60	09:07	11.00	0.61	10.39	8.30	
08/07/90	60	15:05	11.00	0.55	10.45	8.24	8.27
08/09/90	62	09:08	11.00	0.50	10.50	8.19	
08/09/90	62	15:17	11.00	0.51	10.49	8.20	8.20
08/14/90	67	09:02	11.50	0.82	10.68	8.01	
08/14/90	67	15:12	11.50	0.88	10.62	8.07	8.04
08/16/90	69	09:15	11.50	0.75	10.75	7.94	
08/16/90	69	15:24	11.50	0.78	10.72	7.97	7.96
08/28/90	81	09:21	12.00	1.03	10.97	7.72	
08/28/90	81	15:09	12.00	1.08	10.92	7.77	7.75

MW - 6					ELEVATION	
			GL		MSL	MLW
		TEST PIPE	3.15		21.26	22.89
		APRON	0.00		18.11	19.74
GRID LOCATION		SCREEN	-4.00		14.11	15.74
	GRID LINE	WELL BOTT	-14.00		4.11	5.74
	OFFSET					

DATE MONITORED	DAYS FROM START	TIME	TOP OF WELL	WATER READING	DEPTH TO WATER	ELEVATION MSL	AVG ELEVATION
07/24/90	0	09:13	13.00	0.78	12.22	9.04	
07/24/90	0	15:11	13.00	0.79	12.21	9.05	9.05
07/26/90	2	09:13	12.50	1.03	11.47	9.79	
07/26/90	2	15:09	12.50	1.02	11.48	9.78	9.79
07/31/90	7	09:17	12.00	0.76	11.24	10.02	
07/31/90	7	15:11	12.00	0.74	11.26	10.00	10.01
08/02/90	9	09:14	12.00	0.56	11.44	9.82	
08/02/90	9	15:47	12.00	0.61	11.39	9.87	9.85
08/07/90	14	09:17	12.30	0.51	11.79	9.47	
08/07/90	14	15:14	12.30	0.50	11.80	9.46	9.47
08/09/90	16	09:08	12.30	0.42	11.88	9.38	
08/09/90	16	15:24	12.30	0.40	11.90	9.36	9.37
08/14/90	21	09:08	12.50	0.40	12.10	9.16	
08/14/90	21	15:23	12.50	0.39	12.11	9.15	9.16
08/16/90	23	09:22	12.60	0.41	12.19	9.07	
08/16/90	23	15:34	12.60	0.40	12.20	9.06	9.07
08/28/90	35	09:28	13.00	0.47	12.53	8.73	
08/28/90	35	15:16	13.00	0.47	12.53	8.73	8.73

			ELEVATION	
MW - 7		GL	MSL	MLW
	TEST PIPE	2.72	31.25	32.88
	APRON	0.00	28.53	30.16
GRID LOCATION	SCREEN	-10.00	18.53	20.16
GRID LINE	WELL BOTT	-30.00	-1.47	0.16
OFFSET				

DATE MONITORED	DAYS FROM START	TIME	TOP OF WELL	WATER READING	DEPTH TO WATER	ELEVATION MSL	AVG ELEVATION
07/24/90	0	09:37	20.00	0.81	19.19	12.06	
07/24/90	0	15:31	20.00	0.79	19.21	12.04	12.05
07/26/90	2	09:52	18.52	0.70	17.82	13.43	
07/26/90	2	15:28	18.50	0.85	17.65	13.60	13.52
07/31/90	7	09:48	15.20	0.58	14.62	16.63	
07/31/90	7	15:31	15.00	0.31	14.69	16.56	16.60
08/02/90	9	09:37	15.70	0.49	15.21	16.04	
08/02/90	9	16:06	15.70	0.37	15.33	15.92	15.98
08/07/90	14	09:44	17.00	0.37	16.63	14.62	
08/07/90	14	15:34	17.00	0.37	16.63	14.62	14.62
08/09/90	16	09:32	18.00	0.91	17.09	14.16	
08/09/90	16	15:41	18.10	0.95	17.15	14.10	14.13
08/14/90	21	09:28	18.50	0.46	18.04	13.21	
08/14/90	21	15:41	18.50	0.42	18.08	13.17	13.19
08/16/90	23	09:40	18.90	0.49	18.41	12.84	
08/16/90	23	15:50	19.00	0.55	18.45	12.80	12.82
08/28/90	35	09:47	20.30	0.68	19.62	11.63	
08/28/90	35	15:31	20.00	0.37	19.63	11.62	11.63

MW - 10		ELEVATION		
		GL	MSL	MLW
	TEST PIPE	2.13	16.13	17.76
	APRON	0.00	14.00	15.63
GRID LOCATION	SCREEN	-20.30	-6.30	-4.67
GRID LINE	WELL BOTT	-30.30	-16.30	-14.67
OFFSET				

DATE MONITORED	DAYS FROM START	TIME	TOP OF WELL	WATER READING	DEPTH TO WATER	ELEVATION MSL	AVG ELEVATION
06/26/90	0	10:17	15.00	0.97	14.03	2.10	
06/26/90	0	15:34	15.00	1.03	13.97	2.16	2.13
06/28/90	2	09:20	15.00	0.80	14.20	1.93	
06/28/90	2	15:35	15.00	1.00	14.00	2.13	2.03
07/03/90	7	09:22	15.30	1.10	14.20	1.93	
07/03/90	7	15:05	15.00	0.78	14.22	1.91	1.92
07/05/90	9	09:25	15.00	0.78	14.22	1.91	
07/05/90	9	15:37	15.00	0.67	14.33	1.80	1.86
07/10/90	14	09:19	15.00	0.69	14.31	1.82	
07/10/90	14	15:14	15.00	0.58	14.42	1.71	1.77
07/17/90	21	09:07	15.00	0.46	14.54	1.59	
07/17/90	21	15:17	15.00	0.63	14.37	1.76	1.68
07/19/90	23	09:57	15.00	0.57	14.43	1.70	
07/19/90	23	16:05	15.00	0.48	14.52	1.61	1.66
07/24/90	28	09:52	15.00	0.94	14.06	2.07	
07/24/90	28	15:39	15.00	0.80	14.20	1.93	2.00
07/26/90	30	09:34	14.50	0.33	14.17	1.96	
07/26/90	30	15:43	15.00	0.92	14.08	2.05	2.01
07/31/90	35	09:22	15.02	0.72	14.30	1.83	
07/31/90	35	15:14	15.02	0.85	14.17	1.96	1.90
08/02/90	37	09:20	15.00	0.68	14.32	1.81	
08/02/90	37	15:51	15.00	0.67	14.33	1.80	1.81
08/07/90	42	09:20	15.00	0.88	14.12	2.01	
08/07/90	42	15:18	15.00	0.63	14.37	1.76	1.89
08/09/90	44	09:13	15.00	0.73	14.27	1.86	
08/09/90	44	15:28	15.02	0.65	14.37	1.76	1.81
08/14/90	49	09:12	15.00	0.54	14.46	1.67	
08/14/90	49	15:26	15.00	0.82	14.18	1.95	1.81
08/16/90	51	09:26	15.00	0.53	14.47	1.66	
08/16/90	51	15:38	15.00	0.64	14.36	1.77	1.72
08/28/90	63	09:31	15.00	0.52	14.48	1.65	
08/28/90	63	15:19	15.00	0.73	14.27	1.86	1.76

MW - 11		ELEVATION GL	MSL	MLW
	TEST PIPE	0.42	39.08	40.71
	APRON	0.00	38.66	40.29
GRID LOCATION	SCREEN	-30.00	8.66	10.29
GRID LINE	WELL BOTT	-40.00	-1.34	0.29
OFFSET				

DATE MONITORED	DAYS FROM START	TIME	TOP OF WELL	WATER READING	DEPTH TO WATER	ELEVATION MSL	AVG ELEVATION
06/12/90	0	10:13	17.00	0.71	16.29	22.79	
06/12/90	0	15:16	17.00	0.69	16.31	22.77	22.78
06/21/90	9	10:00	18.00	0.64	17.36	21.72	
06/21/90	9	15:13	18.00	0.60	17.40	21.68	21.70
06/26/90	14	09:29	18.50	0.61	17.89	21.19	
06/26/90	14	14:58	18.50	0.56	17.94	21.14	21.17
06/28/90	16	08:52	18.50	0.56	17.94	21.14	
06/28/90	16	15:06	18.50	0.41	18.09	20.99	21.07
07/03/90	21	08:51	19.00	0.62	18.38	20.70	
07/03/90	21	14:38	19.01	0.63	18.38	20.70	20.70
07/05/90	23	08:53	19.00	0.44	18.56	20.52	
07/05/90	23	15:08	19.00	0.43	18.57	20.51	20.52
07/10/90	28	08:47	19.50	0.44	19.06	20.02	
07/10/90	28	14:40	19.50	0.38	19.12	19.96	19.99
07/17/90	35	08:38	20.00	0.79	19.21	19.87	
07/17/90	35	14:51	20.00	0.78	19.22	19.86	19.87
07/19/90	37	08:45	20.00	0.53	19.47	19.61	
07/19/90	37	14:44	20.01	0.51	19.50	19.58	19.60
07/24/90	42	08:37	20.50	0.73	19.77	19.31	
07/24/90	42	14:39	20.50	0.60	19.90	19.18	19.25
07/26/90	44	08:45	19.50	0.62	18.88	20.20	
07/26/90	44	14:44	19.50	0.75	18.75	20.33	20.27
07/31/90	49	08:49	18.50	0.60	17.90	21.18	
07/31/90	49	14:46	18.55	0.63	17.92	21.16	21.17
08/02/90	51	08:49	19.00	0.74	18.26	20.82	
08/02/90	51	14:39	19.00	0.69	18.31	20.77	20.80
08/07/90	56	08:48	19.50	0.51	18.99	20.09	
08/07/90	56	14:48	19.50	0.49	19.01	20.07	20.08
08/09/90	58	08:41	19.50	0.31	19.19	19.89	
08/09/90	58	14:52	20.00	0.77	19.23	19.85	19.87
08/14/90	63	08:42	20.50	0.77	19.73	19.35	
08/14/90	63	14:54	20.60	0.88	19.72	19.36	19.36
08/16/90	65	08:59	20.60	0.58	20.02	19.06	
08/16/90	65	15:08	20.60	0.67	19.93	19.15	19.11
08/28/90	77	08:59	21.00	0.48	20.52	18.56	
08/28/90	77	14:53	21.00	0.49	20.51	18.57	18.57

APPENDIX B
Continuous Water Level Monitoring Data

Continous Water Level Monitoring
McAllister Point Landfill
Newport, RI

DATE	TIME	Elevation (feet) (MW-1) MSL	(MW-3S) MSL	(MW-3D) MSL	(MW-5S) MSL	(MW-5D) MSL	(MW-6) MSL	(MW-7) MSL	(SW-1) MSL
08/21/90	09:30:00 AM	3.65	11.37	7.46	7.93	4.40	8.69	12.13	3.31
08/21/90	09:45:00 AM	3.69	11.35	7.46	7.93	4.42	8.69	12.13	3.31
08/21/90	10:00:00 AM	3.72	11.35	7.45	7.93	4.42	8.69	12.14	3.12
08/21/90	10:15:00 AM	3.75	11.35	7.45	7.93	4.38	8.69	12.13	2.93
08/21/90	10:30:00 AM	3.77	11.35	7.44	7.93	4.33	8.69	12.12	2.75
08/21/90	10:45:00 AM	3.79	11.35	7.44	7.94	4.26	8.69	12.12	2.44
08/21/90	11:00:00 AM	3.81	11.35	7.43	7.93	4.17	8.69	12.12	2.13
08/21/90	11:15:00 AM	3.82	11.35	7.43	7.93	4.05	8.70	12.12	1.81
08/21/90	11:30:00 AM	3.82	11.35	7.42	7.93	3.91	8.70	12.12	1.44
08/21/90	11:45:00 AM	3.83	11.35	7.41	7.92	3.78	8.70	12.12	1.13
08/21/90	12:00:00 PM	3.83	11.35	7.41	7.92	3.62	8.70	12.12	0.70
08/21/90	12:15:00 PM	3.82	11.35	7.40	7.92	3.49	8.70	12.12	0.38
08/21/90	12:30:00 PM	3.82	11.35	7.40	7.91	3.35	8.70	12.12	0.01
08/21/90	12:45:00 PM	3.81	11.35	7.39	7.90	3.18	8.70	12.11	-0.36
08/21/90	01:00:00 PM	3.80	11.35	7.39	7.90	3.05	8.70	12.11	-0.61
08/21/90	01:15:00 PM	3.79	11.35	7.38	7.89	2.91	8.69	12.11	-0.86
08/21/90	01:30:00 PM	3.77	11.35	7.38	7.89	2.82	8.69	12.11	-1.11
08/21/90	01:45:00 PM	3.76	11.35	7.38	7.88	2.70	8.69	12.11	-1.29
08/21/90	02:00:00 PM	3.74	11.35	7.38	7.88	2.62	8.69	12.11	-1.42
08/21/90	02:15:00 PM	3.73	11.35	7.38	7.87	2.52	8.69	12.11	-1.48
08/21/90	02:30:00 PM	3.71	11.35	7.38	7.87	2.45	8.69	12.11	-1.48
08/21/90	02:45:00 PM	3.69	11.35	7.38	7.87	2.39	8.69	12.11	-1.48
08/21/90	03:00:00 PM	3.67	11.35	7.38	7.87	2.34	8.69	12.11	-1.42
08/21/90	03:15:00 PM	3.66	11.35	7.38	7.87	2.30	8.69	12.11	-1.36
08/21/90	03:30:00 PM	3.64	11.36	7.38	7.87	2.28	8.69	12.11	-1.29
08/21/90	03:45:00 PM	3.62	11.36	7.38	7.86	2.27	8.69	12.11	-1.17
08/21/90	04:00:00 PM	3.60	11.36	7.38	7.86	2.26	8.69	12.11	-1.05
08/21/90	04:15:00 PM	3.58	11.36	7.38	7.86	2.27	8.68	12.11	-0.92
08/21/90	04:30:00 PM	3.56	11.36	7.38	7.86	2.29	8.69	12.11	-0.80
08/21/90	04:45:00 PM	3.54	11.36	7.39	7.86	2.32	8.69	12.11	-0.61
08/21/90	05:00:00 PM	3.52	11.36	7.39	7.86	2.36	8.69	12.11	-0.49
08/21/90	05:15:00 PM	3.50	11.36	7.39	7.85	2.40	8.68	12.11	-0.30
08/21/90	05:30:00 PM	3.48	11.36	7.39	7.85	2.45	8.68	12.11	-0.05
08/21/90	05:45:00 PM	3.46	11.37	7.40	7.86	2.53	8.68	12.11	0.14
08/21/90	06:00:00 PM	3.45	11.36	7.40	7.85	2.59	8.68	12.11	0.32
08/21/90	06:15:00 PM	3.43	11.36	7.40	7.86	2.69	8.68	12.11	0.57
08/21/90	06:30:00 PM	3.41	11.36	7.40	7.86	2.79	8.68	12.11	0.88
08/21/90	06:45:00 PM	3.40	11.36	7.41	7.85	2.90	8.68	12.11	1.07
08/21/90	07:00:00 PM	3.39	11.36	7.41	7.86	3.03	8.68	12.11	1.44
08/21/90	07:15:00 PM	3.38	11.36	7.41	7.86	3.16	8.68	12.11	1.69
08/21/90	07:30:00 PM	3.38	11.36	7.41	7.86	3.30	8.68	12.11	1.88
08/21/90	07:45:00 PM	3.38	11.36	7.41	7.87	3.43	8.68	12.11	2.13
08/21/90	08:00:00 PM	3.39	11.36	7.42	7.87	3.56	8.68	12.11	2.37
08/21/90	08:15:00 PM	3.41	11.36	7.40	7.87	3.69	8.68	12.11	2.56
08/21/90	08:30:00 PM	3.43	11.36	7.41	7.87	3.81	8.68	12.10	2.75

Continous Water Level Monitoring
McAllister Point Landfill
Newport, RI

DATE	TIME	Elevation (feet) (MW-1) MSL	(MW-3S) MSL	(MW-3D) MSL	(MW-5S) MSL	(MW-5D) MSL	(MW-6) MSL	(MW-7) MSL	(SW-1) MSL
08/21/90	08:45:00 PM	3.45	11.35	7.42	7.87	3.93	8.68	12.10	2.87
08/21/90	09:00:00 PM	3.47	11.35	7.42	7.88	4.01	8.68	12.10	2.93
08/21/90	09:15:00 PM	3.50	11.35	7.42	7.88	4.09	8.68	12.10	3.00
08/21/90	09:30:00 PM	3.53	11.36	7.42	7.89	4.14	8.68	12.10	3.00
08/21/90	09:45:00 PM	3.56	11.36	7.41	7.89	4.19	8.68	12.10	2.87
08/21/90	10:00:00 PM	3.59	11.36	7.41	7.89	4.20	8.68	12.10	2.87
08/21/90	10:15:00 PM	3.62	11.36	7.41	7.90	4.19	8.68	12.10	2.75
08/21/90	10:30:00 PM	3.64	11.36	7.41	7.90	4.17	8.68	12.10	2.56
08/21/90	10:45:00 PM	3.66	11.36	7.40	7.91	4.11	8.68	12.10	2.37
08/21/90	11:00:00 PM	3.68	11.36	7.40	7.90	4.04	8.68	12.10	2.13
08/21/90	11:15:00 PM	3.69	11.36	7.39	7.90	3.96	8.68	12.10	1.88
08/21/90	11:30:00 PM	3.69	11.36	7.38	7.89	3.87	8.68	12.10	1.63
08/21/90	11:45:00 PM	3.70	11.36	7.38	7.89	3.75	8.68	12.10	1.32
08/22/90	12:00:00 AM	3.71	11.36	7.38	7.89	3.63	8.68	12.10	1.01
08/22/90	12:15:00 AM	3.70	11.36	7.38	7.89	3.51	8.68	12.10	0.70
08/22/90	12:30:00 AM	3.70	11.36	7.37	7.88	3.38	8.68	12.10	0.38
08/22/90	12:45:00 AM	3.69	11.36	7.37	7.88	3.26	8.68	12.10	0.07
08/22/90	01:00:00 AM	3.69	11.37	7.36	7.88	3.13	8.68	12.10	-0.24
08/22/90	01:15:00 AM	3.68	11.37	7.36	7.88	3.01	8.68	12.10	-0.49
08/22/90	01:30:00 AM	3.67	11.37	7.36	7.87	2.90	8.67	12.10	-0.74
08/22/90	01:45:00 AM	3.66	11.37	7.36	7.87	2.79	8.67	12.10	-0.98
08/22/90	02:00:00 AM	3.65	11.37	7.35	7.86	2.68	8.67	12.10	-1.17
08/22/90	02:15:00 AM	3.64	11.37	7.35	7.85	2.59	8.67	12.10	-1.36
08/22/90	02:30:00 AM	3.62	11.37	7.35	7.85	2.51	8.68	12.10	-1.42
08/22/90	02:45:00 AM	3.61	11.37	7.35	7.85	2.43	8.68	12.10	-1.48
08/22/90	03:00:00 AM	3.60	11.37	7.35	7.85	2.37	8.67	12.10	-1.54
08/22/90	03:15:00 AM	3.58	11.37	7.35	7.85	2.31	8.67	12.10	-1.54
08/22/90	03:30:00 AM	3.57	11.38	7.35	7.85	2.26	8.67	12.09	-1.54
08/22/90	03:45:00 AM	3.56	11.38	7.35	7.85	2.21	8.67	12.09	-1.54
08/22/90	04:00:00 AM	3.54	11.38	7.35	7.85	2.19	8.67	12.09	-1.48
08/22/90	04:15:00 AM	3.52	11.38	7.35	7.85	2.17	8.67	12.09	-1.42
08/22/90	04:30:00 AM	3.50	11.38	7.35	7.84	2.16	8.67	12.09	-1.29
08/22/90	04:45:00 AM	3.49	11.38	7.36	7.84	2.16	8.67	12.09	-1.17
08/22/90	05:00:00 AM	3.47	11.37	7.35	7.84	2.17	8.67	12.09	-1.05
08/22/90	05:15:00 AM	3.45	11.37	7.35	7.83	2.19	8.67	12.09	-0.86
08/22/90	05:30:00 AM	3.43	11.37	7.35	7.83	2.21	8.67	12.09	-0.67
08/22/90	05:45:00 AM	3.41	11.37	7.36	7.83	2.25	8.66	12.09	-0.49
08/22/90	06:00:00 AM	3.39	11.37	7.36	7.82	2.31	8.66	12.09	-0.30
08/22/90	06:15:00 AM	3.37	11.37	7.36	7.82	2.38	8.66	12.09	-0.05
08/22/90	06:30:00 AM	3.36	11.37	7.36	7.83	2.46	8.66	12.09	0.26
08/22/90	06:45:00 AM	3.34	11.37	7.36	7.83	2.57	8.66	12.09	0.51
08/22/90	07:00:00 AM	3.33	11.37	7.36	7.83	2.69	8.66	12.09	0.88
08/22/90	07:15:00 AM	3.32	11.37	7.36	7.83	2.79	8.66	12.09	1.13
08/22/90	07:30:00 AM	3.31	11.36	7.36	7.83	2.96	8.66	12.09	1.44
08/22/90	07:45:00 AM	3.30	11.36	7.36	7.83	3.11	8.66	12.08	1.81

Continous Water Level Monitoring
McAllister Point Landfill
Newport, RI

DATE	TIME	Elevation (feet) (MW-1) MSL	(MW-3S) MSL	(MW-3D) MSL	(MW-5S) MSL	(MW-5D) MSL	(MW-6) MSL	(MW-7) MSL	(SW-1) MSL
08/22/90	08:00:00 AM	3.30	11.36	7.36	7.83	3.27	8.66	12.08	2.06
08/22/90	08:15:00 AM	3.31	11.36	7.36	7.84	3.42	8.66	12.08	2.31
08/22/90	08:30:00 AM	3.32	11.36	7.36	7.85	3.57	8.66	12.08	2.56
08/22/90	08:45:00 AM	3.34	11.36	7.36	7.85	3.73	8.66	12.08	2.75
08/22/90	09:00:00 AM	3.35	11.35	7.35	7.86	3.87	8.66	12.08	2.93
08/22/90	09:15:00 AM	3.38	11.36	7.35	7.86	3.97	8.66	12.08	3.00
08/22/90	09:30:00 AM	3.41	11.35	7.35	7.87	4.08	8.66	12.08	3.18
08/22/90	09:45:00 AM	3.44	11.35	7.36	7.87	4.16	8.66	12.11	3.06
08/22/90	10:00:00 AM	3.47	11.35	7.35	7.87	4.22	8.66	12.08	3.12
08/22/90	10:15:00 AM	3.50	11.35	7.35	7.88	4.25	8.66	12.08	3.06
08/22/90	10:30:00 AM	3.54	11.35	7.34	7.88	4.28	8.66	12.08	3.00
08/22/90	10:45:00 AM	3.56	11.36	7.34	7.88	4.26	8.66	12.07	2.81
08/22/90	11:00:00 AM	3.59	11.36	7.34	7.88	4.21	8.66	12.07	2.69
08/22/90	11:15:00 AM	3.61	11.36	7.33	7.89	4.16	8.66	12.07	2.44
08/22/90	11:30:00 AM	3.63	11.35	7.32	7.88	4.10	8.66	12.07	2.19
08/22/90	11:45:00 AM	3.64	11.36	7.32	7.88	4.00	8.66	12.07	1.94
08/22/90	12:00:00 PM	3.66	11.36	7.32	7.88	3.88	8.66	12.07	1.57
08/22/90	12:15:00 PM	3.66	11.36	7.32	7.88	3.77	8.66	12.07	1.32
08/22/90	12:30:00 PM	3.67	11.36	7.31	7.88	3.63	8.66	12.07	0.94
08/22/90	12:45:00 PM	3.67	11.36	7.31	7.87	3.51	8.66	12.07	0.63
08/22/90	01:00:00 PM	3.67	11.36	7.30	7.87	3.36	8.66	12.07	0.32
08/22/90	01:15:00 PM	3.67	11.36	7.29	7.88	3.23	8.66	12.06	0.01
08/22/90	01:30:00 PM	3.66	11.36	7.29	7.87	3.12	8.66	12.07	-0.30
08/22/90	01:45:00 PM	3.65	11.36	7.29	7.86	3.01	8.66	12.06	-0.55
08/22/90	02:00:00 PM	3.64	11.36	7.28	7.86	2.88	8.66	12.06	-0.74
08/22/90	02:15:00 PM	3.63	11.36	7.28	7.86	2.79	8.66	12.06	-0.92
08/22/90	02:30:00 PM	3.62	11.36	7.28	7.85	2.69	8.66	12.06	-1.05
08/22/90	02:45:00 PM	3.61	11.37	7.28	7.85	2.60	8.66	12.07	-1.17
08/22/90	03:00:00 PM	3.60	11.37	7.28	7.85	2.53	8.66	12.06	-1.23
08/22/90	03:15:00 PM	3.58	11.36	7.28	7.85	2.46	8.66	12.06	-1.23
08/22/90	03:30:00 PM	3.57	11.37	7.28	7.85	2.43	8.66	12.07	-1.23
08/22/90	03:45:00 PM	3.55	11.37	7.29	7.84	2.38	8.66	12.07	-1.17
08/22/90	04:00:00 PM	3.54	11.37	7.29	7.84	2.35	8.66	12.07	-1.11
08/22/90	04:15:00 PM	3.52	11.37	7.29	7.83	2.34	8.65	12.07	-1.05
08/22/90	04:30:00 PM	3.51	11.37	7.29	7.83	2.33	8.65	12.07	-0.92
08/22/90	04:45:00 PM	3.49	11.37	7.29	7.83	2.33	8.65	12.07	-0.86
08/22/90	05:00:00 PM	3.47	11.37	7.30	7.83	2.34	8.65	12.07	-0.80
08/22/90	05:15:00 PM	3.45	11.37	7.30	7.82	2.34	8.65	12.07	-0.67
08/22/90	05:30:00 PM	3.44	11.37	7.30	7.83	2.36	8.65	12.07	-0.49
08/22/90	05:45:00 PM	3.42	11.37	7.31	7.82	2.40	8.65	12.07	-0.36
08/22/90	06:00:00 PM	3.41	11.37	7.31	7.82	2.44	8.65	12.07	-0.18
08/22/90	06:15:00 PM	3.39	11.37	7.32	7.82	2.49	8.65	12.07	0.01
08/22/90	06:30:00 PM	3.37	11.37	7.32	7.82	2.56	8.65	12.07	0.26
08/22/90	06:45:00 PM	3.35	11.37	7.32	7.82	2.64	8.65	12.07	0.45
08/22/90	07:00:00 PM	3.34	11.36	7.32	7.82	2.73	8.65	12.07	0.70

Continous Water Level Monitoring
McAllister Point Landfill
Newport, RI

DATE	TIME	(MW-1) MSL	(MW-3S) MSL	(MW-3D) MSL	(MW-5S) MSL	Elevation (feet) (MW-5D) MSL	(MW-6) MSL	(MW-7) MSL	(SW-1) MSL
08/22/90	07:15:00 PM	3.33	11.36	7.32	7.82	2.83	8.66	12.07	0.94
08/22/90	07:30:00 PM	3.32	11.36	7.32	7.83	2.94	8.66	12.07	1.19
08/22/90	07:45:00 PM	3.31	11.36	7.32	7.83	3.05	8.65	12.07	1.44
08/22/90	08:00:00 PM	3.30	11.36	7.32	7.83	3.17	8.65	12.07	1.69
08/22/90	08:15:00 PM	3.30	11.36	7.31	7.83	3.30	8.65	12.07	1.94
08/22/90	08:30:00 PM	3.31	11.36	7.32	7.83	3.43	8.65	12.07	2.13
08/22/90	08:45:00 PM	3.32	11.36	7.31	7.83	3.55	8.65	12.07	2.31
08/22/90	09:00:00 PM	3.33	11.36	7.31	7.84	3.67	8.65	12.07	2.50
08/22/90	09:15:00 PM	3.34	11.36	7.31	7.85	3.79	8.65	12.07	2.69
08/22/90	09:30:00 PM	3.36	11.36	7.31	7.85	3.89	8.65	12.07	2.81
08/22/90	09:45:00 PM	3.38	11.36	7.31	7.85	3.99	8.65	12.06	2.87
08/22/90	10:00:00 PM	3.41	11.35	7.31	7.85	4.06	8.65	12.06	2.93
08/22/90	10:15:00 PM	3.43	11.36	7.32	7.86	4.10	8.65	12.06	2.87
08/22/90	10:30:00 PM	3.46	11.36	7.32	7.87	4.13	8.65	12.06	2.87
08/22/90	10:45:00 PM	3.48	11.36	7.32	7.87	4.14	8.65	12.06	2.75
08/22/90	11:00:00 PM	3.51	11.37	7.32	7.88	4.14	8.65	12.06	2.69
08/22/90	11:15:00 PM	3.53	11.37	7.32	7.88	4.11	8.65	12.06	2.50
08/22/90	11:30:00 PM	3.55	11.37	7.32	7.88	4.06	8.65	12.06	2.31
08/22/90	11:45:00 PM	3.57	11.37	7.31	7.88	3.99	8.65	12.06	2.06
08/23/90	12:00:00 AM	3.59	11.37	7.31	7.87	3.91	8.65	12.06	1.81
08/23/90	12:15:00 AM	3.60	11.37	7.30	7.87	3.81	8.64	12.06	1.57
08/23/90	12:30:00 AM	3.60	11.37	7.30	7.87	3.70	8.64	12.06	1.26
08/23/90	12:45:00 AM	3.61	11.37	7.30	7.87	3.58	8.64	12.06	0.88
08/23/90	01:00:00 AM	3.61	11.37	7.29	7.87	3.45	8.64	12.06	0.57
08/23/90	01:15:00 AM	3.61	11.37	7.29	7.86	3.31	8.64	12.06	0.26
08/23/90	01:30:00 AM	3.60	11.37	7.28	7.86	3.19	8.64	12.06	-0.05
08/23/90	01:45:00 AM	3.60	11.38	7.28	7.85	3.06	8.64	12.06	-0.30
08/23/90	02:00:00 AM	3.59	11.38	7.28	7.85	2.94	8.64	12.06	-0.61
08/23/90	02:15:00 AM	3.58	11.37	7.27	7.85	2.83	8.64	12.06	-0.86
08/23/90	02:30:00 AM	3.57	11.37	7.27	7.84	2.73	8.64	12.06	-1.05
08/23/90	02:45:00 AM	3.56	11.37	7.26	7.83	2.63	8.64	12.06	-1.23
08/23/90	03:00:00 AM	3.54	11.37	7.26	7.83	2.54	8.64	12.06	-1.29
08/23/90	03:15:00 AM	3.53	11.38	7.26	7.83	2.46	8.64	12.06	-1.36
08/23/90	03:30:00 AM	3.52	11.38	7.26	7.83	2.40	8.64	12.06	-1.36
08/23/90	03:45:00 AM	3.50	11.38	7.27	7.82	2.35	8.64	12.06	-1.36
08/23/90	04:00:00 AM	3.49	11.38	7.27	7.82	2.31	8.64	12.06	-1.29
08/23/90	04:15:00 AM	3.47	11.37	7.27	7.81	2.28	8.63	12.06	-1.23
08/23/90	04:30:00 AM	3.45	11.37	7.27	7.81	2.27	8.63	12.06	-1.17
08/23/90	04:45:00 AM	3.44	11.37	7.27	7.81	2.25	8.63	12.06	-1.11
08/23/90	05:00:00 AM	3.42	11.37	7.26	7.82	2.25	8.63	12.06	-0.98
08/23/90	05:15:00 AM	3.40	11.37	7.26	7.81	2.25	8.63	12.06	-0.92
08/23/90	05:30:00 AM	3.38	11.37	7.27	7.81	2.27	8.63	12.06	-0.80
08/23/90	05:45:00 AM	3.37	11.37	7.27	7.81	2.27	8.63	12.06	-0.67
08/23/90	06:00:00 AM	3.35	11.36	7.27	7.81	2.30	8.63	12.06	-0.55
08/23/90	06:15:00 AM	3.33	11.36	7.27	7.81	2.34	8.63	12.06	-0.42

Continous Water Level Monitoring
McAllister Point Landfill
Newport, RI

DATE	TIME	(MW-1) MSL	(MW-3S) MSL	(MW-3D) MSL	(MW-5S) MSL	(MW-5D) MSL	(MW-6) MSL	(MW-7) MSL	(SW-1) MSL
		Elevation (feet)							
08/23/90	06:30:00 AM	3.31	11.36	7.27	7.81	2.38	8.63	12.06	-0.24
08/23/90	06:45:00 AM	3.30	11.36	7.27	7.80	2.43	8.63	12.06	-0.05
08/23/90	07:00:00 AM	3.28	11.36	7.27	7.80	2.48	8.63	12.06	0.14
08/23/90	07:15:00 AM	3.27	11.36	7.27	7.81	2.56	8.63	12.06	0.38
08/23/90	07:30:00 AM	3.26	11.36	7.28	7.81	2.66	8.63	12.05	0.57
08/23/90	07:45:00 AM	3.24	11.36	7.28	7.81	2.74	8.63	12.05	0.82
08/23/90	08:00:00 AM	3.24	11.36	7.28	7.81	2.86	8.63	12.05	1.13
08/23/90	08:15:00 AM	3.23	11.36	7.28	7.82	2.98	8.63	12.05	1.38
08/23/90	08:30:00 AM	3.22	11.35	7.28	7.82	3.11	8.63	12.05	1.63
08/23/90	08:45:00 AM	3.22	11.36	7.28	7.82	3.24	8.63	12.05	1.94
08/23/90	09:00:00 AM	3.23	11.36	7.28	7.83	3.39	8.63	12.05	2.19
08/23/90	09:15:00 AM	3.24	11.36	7.28	7.83	3.52	8.63	12.05	2.37
08/23/90	09:30:00 AM	3.25	11.36	7.28	7.83	3.67	8.63	12.05	2.62
08/23/90	09:45:00 AM	3.27	11.36	7.29	7.83	3.79	8.62	12.07	2.75
08/23/90	10:00:00 AM	3.29	11.35	7.28	7.83	3.89	8.62	12.05	2.87
08/23/90	10:15:00 AM	3.32	11.35	7.28	7.84	3.98	8.63	12.05	3.00
08/23/90	10:30:00 AM	3.34	11.35	7.28	7.84	4.07	8.63	12.05	3.00
08/23/90	10:45:00 AM	3.38	11.35	7.27	7.85	4.13	8.63	12.05	3.00
08/23/90	11:00:00 AM	3.41	11.35	7.27	7.85	4.16	8.62	12.05	3.00
08/23/90	11:15:00 AM	3.45	11.35	7.26	7.86	4.18	8.63	12.04	2.87
08/23/90	11:30:00 AM	3.48	11.35	7.26	7.86	4.15	8.63	12.04	2.69
08/23/90	11:45:00 AM	3.51	11.35	7.25	7.86	4.13	8.63	12.04	2.50
08/23/90	12:00:00 PM	3.53	11.35	7.25	7.86	4.07	8.63	12.04	2.31
08/23/90	12:15:00 PM	3.56	11.36	7.25	7.86	3.99	8.63	12.04	2.06
08/23/90	12:30:00 PM	3.57	11.36	7.25	7.86	3.89	8.62	12.04	1.81
08/23/90	12:45:00 PM	3.58	11.35	7.25	7.86	3.79	8.62	12.04	1.50
08/23/90	01:00:00 PM	3.59	11.35	7.25	7.86	3.68	8.62	12.04	1.13
08/23/90	01:15:00 PM	3.59	11.35	7.25	7.85	3.55	8.62	12.04	0.82
08/23/90	01:30:00 PM	3.59	11.35	7.25	7.85	3.43	8.63	12.04	0.51
08/23/90	01:45:00 PM	3.59	11.35	7.25	7.85	3.30	8.62	12.04	0.20
08/23/90	02:00:00 PM	3.59	11.35	7.25	7.84	3.16	8.62	12.04	-0.18
08/23/90	02:15:00 PM	3.58	11.35	7.24	7.84	3.04	8.62	12.04	-0.42
08/23/90	02:30:00 PM	3.58	11.36	7.24	7.83	2.92	8.62	12.04	-0.67
08/23/90	02:45:00 PM	3.57	11.36	7.24	7.83	2.80	8.62	12.04	-0.92
08/23/90	03:00:00 PM	3.56	11.36	7.24	7.83	2.72	8.62	12.04	-1.11
08/23/90	03:15:00 PM	3.54	11.37	7.24	7.82	2.61	8.62	12.04	-1.23
08/23/90	03:30:00 PM	3.53	11.37	7.24	7.82	2.53	8.62	12.04	-1.29
08/23/90	03:45:00 PM	3.52	11.36	7.24	7.82	2.46	8.62	12.07	-1.36
08/23/90	04:00:00 PM	3.50	11.37	7.24	7.81	2.40	8.62	12.04	-1.29
08/23/90	04:15:00 PM	3.49	11.37	7.24	7.80	2.35	8.62	12.04	-1.29
08/23/90	04:30:00 PM	3.47	11.37	7.24	7.80	2.33	8.62	12.04	-1.17
08/23/90	04:45:00 PM	3.45	11.37	7.24	7.80	2.30	8.62	12.04	-1.11
08/23/90	05:00:00 PM	3.44	11.37	7.24	7.80	2.29	8.62	12.04	-0.98
08/23/90	05:15:00 PM	3.42	11.38	7.24	7.80	2.28	8.62	12.04	-0.92
08/23/90	05:30:00 PM	3.40	11.38	7.25	7.80	2.29	8.62	12.04	-0.80
08/23/90	05:45:00 PM	3.39	11.38	7.24	7.79	2.31	8.62	12.04	-0.67

Continous Water Level Monitoring
McAllister Point Landfill
Newport, RI

DATE	TIME	Elevation (feet) (MW-1) MSL	(MW-3S) MSL	(MW-3D) MSL	(MW-5S) MSL	(MW-5D) MSL	(MW-6) MSL	(MW-7) MSL	(SW-1) MSL
08/23/90	06:00:00 PM	3.37	11.38	7.25	7.80	2.34	8.62	12.04	-0.49
08/23/90	06:15:00 PM	3.35	11.38	7.25	7.79	2.37	8.63	12.04	-0.36
08/23/90	06:30:00 PM	3.33	11.37	7.25	7.78	2.41	8.62	12.04	-0.24
08/23/90	06:45:00 PM	3.31	11.38	7.25	7.79	2.46	8.63	12.04	-0.11
08/23/90	07:00:00 PM	3.30	11.37	7.25	7.79	2.51	8.62	12.04	0.07
08/23/90	07:15:00 PM	3.28	11.37	7.25	7.78	2.56	8.62	12.04	0.26
08/23/90	07:30:00 PM	3.27	11.37	7.25	7.78	2.63	8.62	12.04	0.45
08/23/90	07:45:00 PM	3.26	11.37	7.25	7.78	2.72	8.62	12.04	0.63
08/23/90	08:00:00 PM	3.24	11.37	7.25	7.78	2.79	8.62	12.04	0.82
08/23/90	08:15:00 PM	3.23	11.37	7.25	7.78	2.88	8.62	12.04	1.01
08/23/90	08:30:00 PM	3.22	11.36	7.25	7.79	2.97	8.62	12.04	1.19
08/23/90	08:45:00 PM	3.22	11.36	7.25	7.79	3.07	8.62	12.04	1.38
08/23/90	09:00:00 PM	3.22	11.37	7.25	7.79	3.17	8.62	12.04	1.57
08/23/90	09:15:00 PM	3.22	11.37	7.25	7.79	3.26	8.62	12.04	1.75
08/23/90	09:30:00 PM	3.22	11.37	7.25	7.80	3.36	8.62	12.04	1.94
08/23/90	09:45:00 PM	3.22	11.37	7.25	7.80	3.47	8.62	12.04	2.06
08/23/90	10:00:00 PM	3.24	11.37	7.25	7.81	3.56	8.62	12.04	2.25
08/23/90	10:15:00 PM	3.25	11.37	7.25	7.81	3.64	8.62	12.04	2.31
08/23/90	10:30:00 PM	3.26	11.37	7.25	7.81	3.72	8.62	12.04	2.44
08/23/90	10:45:00 PM	3.28	11.37	7.25	7.82	3.78	8.62	12.04	2.44
08/23/90	11:00:00 PM	3.30	11.37	7.25	7.82	3.83	8.62	12.04	2.44
08/23/90	11:15:00 PM	3.32	11.37	7.25	7.81	3.87	8.62	12.04	2.44
08/23/90	11:30:00 PM	3.34	11.36	7.25	7.82	3.89	8.62	12.04	2.37
08/23/90	11:45:00 PM	3.36	11.36	7.25	7.82	3.89	8.62	12.04	2.31
08/24/90	12:00:00 AM	3.39	11.36	7.25	7.82	3.88	8.62	12.03	2.25
08/24/90	12:15:00 AM	3.41	11.36	7.24	7.82	3.85	8.61	12.04	2.00
08/24/90	12:30:00 AM	3.42	11.36	7.24	7.83	3.79	8.61	12.03	1.81
08/24/90	12:45:00 AM	3.43	11.36	7.23	7.82	3.72	8.61	12.03	1.63
08/24/90	01:00:00 AM	3.44	11.37	7.23	7.83	3.63	8.61	12.03	1.38
08/24/90	01:15:00 AM	3.45	11.38	7.22	7.83	3.53	8.61	12.03	1.01
08/24/90	01:30:00 AM	3.45	11.37	7.22	7.83	3.42	8.61	12.03	0.76
08/24/90	01:45:00 AM	3.45	11.38	7.22	7.83	3.30	8.61	12.03	0.38
08/24/90	02:00:00 AM	3.45	11.38	7.22	7.82	3.18	8.61	12.03	0.14
08/24/90	02:15:00 AM	3.45	11.38	7.21	7.81	3.06	8.61	12.03	-0.18
08/24/90	02:30:00 AM	3.44	11.38	7.21	7.81	2.94	8.61	12.03	-0.49
08/24/90	02:45:00 AM	3.43	11.38	7.21	7.80	2.83	8.61	12.03	-0.74
08/24/90	03:00:00 AM	3.43	11.38	7.20	7.80	2.72	8.61	12.03	-0.92
08/24/90	03:15:00 AM	3.41	11.38	7.20	7.79	2.63	8.61	12.03	-1.11
08/24/90	03:30:00 AM	3.40	11.38	7.20	7.79	2.53	8.61	12.03	-1.29
08/24/90	03:45:00 AM	3.39	11.38	7.20	7.78	2.46	8.61	12.03	-1.29
08/24/90	04:00:00 AM	3.37	11.37	7.19	7.77	2.39	8.61	12.03	-1.36
08/24/90	04:15:00 AM	3.36	11.37	7.19	7.77	2.34	8.61	12.03	-1.36
08/24/90	04:30:00 AM	3.34	11.38	7.19	7.77	2.29	8.61	12.03	-1.23
08/24/90	04:45:00 AM	3.33	11.38	7.19	7.77	2.27	8.61	12.03	-1.23
08/24/90	05:00:00 AM	3.31	11.38	7.19	7.77	2.25	8.61	12.03	-1.05
08/24/90	05:15:00 AM	3.30	11.38	7.19	7.77	2.25	8.61	12.03	-0.92

Continous Water Level Monitoring
McAllister Point Landfill
Newport, RI

DATE	TIME	Elevation (feet) (MW-1) MSL	(MW-3S) MSL	(MW-3D) MSL	(MW-5S) MSL	(MW-5D) MSL	(MW-6) MSL	(MW-7) MSL	(SW-1) MSL
08/24/90	05:30:00 AM	3.28	11.38	7.19	7.77	2.26	8.61	12.03	-0.80
08/24/90	05:45:00 AM	3.27	11.38	7.19	7.76	2.27	8.61	12.03	-0.74
08/24/90	06:00:00 AM	3.25	11.38	7.20	7.76	2.29	8.60	12.03	-0.55
08/24/90	06:15:00 AM	3.24	11.38	7.20	7.76	2.32	8.60	12.03	-0.49
08/24/90	06:30:00 AM	3.22	11.37	7.20	7.76	2.35	8.60	12.03	-0.30
08/24/90	06:45:00 AM	3.20	11.37	7.20	7.76	2.40	8.60	12.03	-0.11
08/24/90	07:00:00 AM	3.19	11.37	7.20	7.75	2.45	8.60	12.03	0.01
08/24/90	07:15:00 AM	3.17	11.36	7.19	7.75	2.51	8.60	12.02	0.14
08/24/90	07:30:00 AM	3.16	11.37	7.20	7.75	2.57	8.60	12.02	0.32
08/24/90	07:45:00 AM	3.15	11.37	7.20	7.75	2.62	8.60	12.02	0.45
08/24/90	08:00:00 AM	3.14	11.37	7.20	7.76	2.70	8.60	12.02	0.63
08/24/90	08:15:00 AM	3.13	11.37	7.19	7.77	2.79	8.60	12.02	0.88
08/24/90	08:30:00 AM	3.12	11.37	7.22	7.77	2.88	8.60	12.02	1.01
08/24/90	08:45:00 AM	3.11	11.37	7.22	7.77	2.97	8.60	12.02	1.26
08/24/90	09:00:00 AM	3.11	11.36	7.22	7.77	3.07	8.59	12.02	1.50
08/24/90	09:15:00 AM	3.11	11.37	7.22	7.77	3.18	8.60	12.02	1.69
08/24/90	09:30:00 AM	3.11	11.35	7.21	7.77	3.30	8.60	12.02	

APPENDIX C
Metals Analysis Summary - Groundwater Samples

Constituents Detected in Groundwater
McAllister Point Landfill
Newport, RI

As of: 01/14/91

Sample Identification:	MW-1D	MW-3S	MW-3D	MW-4S	MW-5S	MW-5D	MW-10S	MW-11D	GS-1
** Inorganics (PPB) **									
Silver		126							
Aluminum	130000	205000	6890	69500	284000	412	1880	3270	
Arsenic	18	85.8		26.9	71.4		64.8	54.2	
Barium		1770		212	895				
Beryllium		9.5			12.8				
Calcium	22400	139000	40000		49600	9030	31400	10100	287000
Cadmium		57.1			5.6				
Cobalt	160	243		130	339				
Copper	269	3160	47.6	333	599		49.9	31.4	
Iron	327000	600000	40300	339000	537000	702	34100	58800	210
Mercury		8.4		0.79	1.3		0.44		
Potassium	5180	22700		11300	25600		6270		310000
Magnesium	54300	89200	17500	33500	70300		14100	9420	1090000
Manganese	2910	13500	2090	6550	4760	57.8	5190	1140	55
Sodium	34000	74500	42900	13100	29500	9750	41800	14900	8780000
Nickel	306	517	70.6	190	658			40	
Lead	60	4800	25.7	197	4.3		44.4	42.8	
Antimony		259		64.2	101				77
Vanadium	259	1330		270	689				79
Zinc	588	12100	200	1260	2100	20.5	110	105	
Cyanide	0	0	0	0	0	0	0	0	

Source: Roy F. Weston, Inc. Laboratory Reports to TRC Environmnetal Consultants 12 March and 2 October 1990.

APPENDIX D.
HELP Model Precipitation Data - Nov 1989 - August 1990

Precipitation Data For McAllister Point Landfill
Infiltration Simulations
12 Month Period beginning 1 November 1989 ending 31 October 1990
Compiled from City of Newport Water Department Pumpage Records

90	0.00	0.00	0.79	0.01	0.00	0.00	0.00	0.72	1.70	0.10	1
90	0.00	0.00	0.00	0.00	0.31	0.66	0.00	0.00	0.00	0.31	2
90	0.00	0.00	0.03	0.00	0.00	0.08	0.00	0.00	0.38	0.00	3
90	0.00	0.08	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	4
90	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.04	5
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.07	0.00	6
90	0.87	0.27	0.00	0.00	0.29	0.00	0.00	0.00	0.70	0.17	7
90	0.11	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00	8
90	0.40	0.58	0.32	0.00	0.04	0.51	0.94	0.00	0.00	1.05	9
90	0.32	0.00	0.00	0.20	0.00	0.58	0.00	0.00	0.00	0.00	10
90	0.00	0.00	0.78	0.00	0.00	0.00	0.00	0.12	0.44	0.00	11
90	0.00	0.00	0.00	0.72	0.33	0.55	0.15	0.00	0.10	0.00	12
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	13
90	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	14
90	0.00	0.41	0.00	0.44	0.11	0.00	0.00	0.00	0.00	0.00	15
90	0.00	0.00	0.49	0.19	0.00	0.00	0.92	1.65	0.01	0.03	16
90	0.12	0.00	0.00	0.00	0.88	0.00	0.00	0.00	0.60	0.00	17
90	0.17	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.08	0.00	18
90	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.85	0.00	19
90	0.03	0.28	0.00	0.00	0.83	0.00	0.02	0.75	0.00	0.43	20
90	0.23	0.00	0.00	0.01	0.29	0.06	0.00	0.00	0.00	0.00	21
90	0.00	0.00	0.38	0.58	0.00	0.00	0.00	0.00	0.11	0.00	22
90	0.00	0.38	0.00	0.02	0.69	0.03	0.00	0.00	0.00	0.00	23
90	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.08	0.00	0.00	24
90	0.00	0.00	0.00	0.00	0.35	0.11	0.57	0.00	0.00	0.00	25
90	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.88	0.00	0.00	26
90	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.75	1.71	27
90	0.00	1.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28
90	0.00	0.00	0.27	0.02	0.00	0.00	0.00	0.10	0.00	0.00	29
90	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.52	30
90	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	31
90	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	32
90	0.00	0.95	0.00	0.18	0.00	0.00	0.40	0.00	0.00	1.19	33
90	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	34
90	0.00	0.18	0.00	0.00	0.02	0.00	0.00	0.03	0.10	0.50	35
90	1.19	0.00	0.00	0.00	0.00	0.82	0.00	0.00	0.00	0.36	36
90	0.60	0.00	0.43	0.11	0.28	0.00	0.00	0.00	0.00	0.00	37

DEFAULT, UNVEGETATED, UNCOMPACTED SOIL CHARACTERISTICS - HELP

SOIL TEXTURE			DIMENSIONLESS			SAT. HYD. CONDUCTIVITY (CM/SEC)
HELP	USDA	USCS	POROSITY	FIELD CAPACITY	WILTING POINT	
1	CoS	GS	0.417	0.045	0.018	1.0E-02
2	S	SW	0.437	0.062	0.024	5.8E-03
3	FS	SM	0.457	0.083	0.033	3.1E-03
4	LS	SM	0.437	0.105	0.047	1.7E-03
5	LFS	SM	0.457	0.131	0.058	1.0E-03
6	SL	SM	0.453	0.190	0.085	7.2E-04
7	FSL	SM	0.473	0.222	0.104	5.2E-04
8	L	ML	0.463	0.232	0.116	3.7E-04
9	SiL	ML	0.501	0.284	0.135	1.9E-04
10	SCL	SC	0.398	0.244	0.136	1.2E-04
11	CL	CL	0.464	0.310	0.187	6.4E-05
12	SiCL	CL	0.471	0.342	0.210	4.2E-05
13	SC	CH	0.430	0.321	0.221	3.3E-05
14	SiC	CH	0.479	0.371	0.251	2.5E-05
15	C	CH	0.475	0.378	0.265	1.7E-05
16	Liner Soil		0.430	0.366	0.280	1.0E-07
17	Liner Soil		0.400	0.356	0.290	1.0E-08
18	Mun. Waste		0.520	0.294	0.140	2.0E-04
19	USER SPECIFIED SOIL CHARACTERISTICS					
20	USER SPECIFIED SOIL CHARACTERISTICS					

(EPA, 1983)

APPENDIX E

HELP Model Output

GOOD GRASS

LAYER 1

VERTICAL PERCOLATION LAYER

THICKNESS	=	24.00 INCHES
POROSITY	=	0.3980 VOL/VOL
FIELD CAPACITY	=	0.2443 VOL/VOL
WILTING POINT	=	0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2443 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000503999900 CM/SEC

LAYER 2

VERTICAL PERCOLATION LAYER

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4640 VOL/VOL
FIELD CAPACITY	=	0.3104 VOL/VOL
WILTING POINT	=	0.1875 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3104 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000064000000 CM/SEC

LAYER 3

VERTICAL PERCOLATION LAYER

THICKNESS	=	96.00 INCHES
POROSITY	=	0.5200 VOL/VOL
FIELD CAPACITY	=	0.2942 VOL/VOL
WILTING POINT	=	0.1400 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2942 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000200000000 CM/SEC

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER	=	80.12
TOTAL AREA OF COVER	=	435600. SQ FT
EVAPORATIVE ZONE DEPTH	=	20.00 INCHES
UPPER LIMIT VEG. STORAGE	=	7.9600 INCHES
INITIAL VEG. STORAGE	=	6.0855 INCHES
INITIAL SNOW WATER CONTENT	=	0.0000 INCHES

INITIAL TOTAL WATER STORAGE IN
SOIL AND WASTE LAYERS = 41.5560 INCHES

SOIL WATER CONTENT INITIALIZED BY PROGRAM.

CLIMATOLOGICAL DATA

DEFAULT RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR PROVIDENCE RHODE ISLAND

MAXIMUM LEAF AREA INDEX = 3.30
START OF GROWING SEASON (JULIAN DATE) = 131
END OF GROWING SEASON (JULIAN DATE) = 286

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
28.20	29.30	37.40	47.90	57.60	66.80
72.50	71.10	63.50	53.20	43.40	32.20

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 90 THROUGH 90

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.09	0.86	6.44	4.29	1.30	5.74
	4.18	2.28	6.33	0.98	2.91	4.62
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.255	0.000	0.013	0.000	0.000	0.116
	0.000	0.000	0.128	0.000	0.009	0.021
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	0.862	1.268	2.283	3.774	2.534	5.773
	4.180	2.280	3.115	2.286	1.008	0.927

STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

PERCOLATION FROM LAYER 3

TOTALS	1.7606	2.0159	1.6065	2.0540	1.7647	1.2096
	0.9669	0.7658	0.6047	0.5382	0.4840	0.4924
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 90 THROUGH 90

	(INCHES)		(CU. FT.)	PERCENT
PRECIPITATION	45.02	(0.000)	1634226.	100.00
RUNOFF	0.543	(0.000)	19703.	1.21
EVAPOTRANSPIRATION	30.291	(0.000)	1099565.	67.28
PERCOLATION FROM LAYER 3	14.2634	(0.0000)	517760.	31.68
CHANGE IN WATER STORAGE	-0.077	(0.000)	-2802.	-0.17

PEAK DAILY VALUES FOR YEARS 90 THROUGH 90

	(INCHES)	(CU. FT.)
PRECIPITATION	1.71	62073.0
RUNOFF	0.255	9273.0
PERCOLATION FROM LAYER 3	0.0816	2962.9
SNOW WATER	1.11	40207.6

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3458
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1361

FINAL WATER STORAGE AT END OF YEAR 90

LAYER	(INCHES)	(VOL/VOL)
1	7.38	0.3076
2	9.43	0.3931

3	31.00	0.3229
SNOW WATER	0.00	

MCALLISTER POINT LANDFILL INFILTRATION EVALUATION
WATERSHED PORTION MIDDLETOWN, RI 17 NOVEMBER 1990

GOOD GRASS

LAYER 1

VERTICAL PERCOLATION LAYER

THICKNESS	=	144.00 INCHES
POROSITY	=	0.3980 VOL/VOL
FIELD CAPACITY	=	0.2443 VOL/VOL
WILTING POINT	=	0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2443 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY	=	0.000503999900 CM/SEC

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER	=	80.12
TOTAL AREA OF COVER	=	435600. SQ FT
EVAPORATIVE ZONE DEPTH	=	20.00 INCHES
UPPER LIMIT VEG. STORAGE	=	7.9600 INCHES
INITIAL VEG. STORAGE	=	6.0855 INCHES
INITIAL SNOW WATER CONTENT	=	0.0000 INCHES
INITIAL TOTAL WATER STORAGE IN SOIL AND WASTE LAYERS	=	35.1792 INCHES

SOIL WATER CONTENT INITIALIZED BY PROGRAM.

CLIMATOLOGICAL DATA

DEFAULT RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR PROVIDENCE RHODE ISLAND

MAXIMUM LEAF AREA INDEX	=	3.30
START OF GROWING SEASON (JULIAN DATE)	=	131
END OF GROWING SEASON (JULIAN DATE)	=	286

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
28.20	29.30	37.40	47.90	57.60	66.80
72.50	71.10	63.50	53.20	43.40	32.20

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 90 THROUGH 90

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.09	0.86	6.44	4.29	1.30	5.74
	4.18	2.28	6.33	0.98	2.91	4.62
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.255	0.000	0.013	0.000	0.000	0.116
	0.000	0.000	0.128	0.000	0.009	0.021
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	0.862	1.267	2.283	3.773	2.534	5.773
	4.180	2.280	3.115	2.294	0.851	0.927
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
PERCOLATION FROM LAYER 1						
TOTALS	2.6523	1.9436	1.5418	2.2989	1.4836	0.9862
	0.7618	0.5699	0.4403	0.5096	0.4417	0.6558
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 90 THROUGH 90

	(INCHES)		(CU. FT.)	PERCENT
PRECIPITATION	45.02	(0.000)	1634226.	100.00
RUNOFF	0.543	(0.000)	19715.	1.21
EVAPOTRANSPIRATION	30.138	(0.000)	1094027.	66.94
PERCOLATION FROM LAYER 1	14.2856	(0.0000)	518566.	31.73
CHANGE IN WATER STORAGE	0.053	(0.000)	1917.	0.12

PEAK DAILY VALUES FOR YEARS 90 THROUGH 90

	(INCHES)	(CU. FT.)
PRECIPITATION	1.71	62073.0
RUNOFF	0.255	9274.0
PERCOLATION FROM LAYER 1	0.1061	3851.7
SNOW WATER	1.11	40207.6
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.3458
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.1361

FINAL WATER STORAGE AT END OF YEAR 90

LAYER	(INCHES)	(VOL/VOL)
1	42.00	0.2917
SNOW WATER	0.00	

APPENDIX F

Boring Logs for Monitoring Wells

BORING NO.:	MP-MW01D	CONTRACTOR:	CDS	DATE STARTED:	1/23/90
PROJECT NO.:	6760-N81	DRILLERS:	JORDAN/GAYLORD	DATE COMPLETED:	1/24/90
PROJECT:	McALLISTER POINT	TRC INSPECTOR:	ZLOTNICK/BARRETT	WATER TABLE LEVEL:	24.3 FT
CLIENT:	U.S.NAVY	DRILLING METHOD:	4-1/4 HOLLOW STEM AUGERS	LOCATION:	
LOCATION:	NEWPORT.RI	GROUND ELEVATION:			
BORING DEPTH:	38.0 FT	CASING ELEVATION:			

DEPTH (FT)	BLOWS	OVA (PPM)	SOIL DESCRIPTION
0 - 2	18 19 20 17	2.4	F SAND AND SILT. SOME ROOTS AND ORGANICS. BROWN. DAMP.(3")
2 - 4	5 6 5 6	2.2	FILL. F-C SAND. LT BROWN. SOME PLASTIC AND RUBBER DEBRIS.(6"): F-M SAND AND SILT. LITTLE SHALE FRAGS. BROWN. DRY.(6")
4 - 6	15 18 25 31	2.4	TILL. F SAND AND SILT. SOME WEATHERED SHALE FRAGS. BROWN. DRY.(22")
6 - 8	16 21 16 28	2.8	TILL. SAME AS 4-6 FT
8 - 10	19 38 47 70	2.6	WEATHERED SHALE. BROWN. DRY.(12"): WEATHERED SHALE. FISSILE. DK GREY.(12")
10 - 12	17 67 100	3.6	WEATHERED SHALE. FISSILE. GREY. DRY.(14")
12 - 14	40 87 100	3.4	WEATHERED SHALE. GREY. IRON OXIDE ALONG FRACTURES.(14")
14 - 16	40 100	3.4	WEATHERED SHALE. SAME AS 12-14 FT.(8")
16 - 18	47 100	2.6	WEATHERED SHALE. SAME AS 12-14 FT.(6")
18 - 20	47 100	3.2	WEATHERED SHALE. SAME AS 12-14 FT.(4")
20 - 22	100		WEATHERED SHALE. SAME AS 12-14 FT.(2")
23 - 25	100		WEATHERED SHALE. BROWN. CLAYEY WHEN WET.(2")
28 - 30	100		WEATHERED SHALE. DK GREY. SILT AND CLAY IN FRACTURES.(5")
33 - 35	100		WEATHERED SHALE. BROWN. CLAYEY WHEN WET.(2")
38 - 40	100		WEATHERED SHALE. GRAY.(2") END OF BORING AT 38.0 FT

(TRC, 1988)

BORING NO.:	MP-MW03S	CONTRACTOR:	COS	DATE STARTED:	1/15/90
PROJECT NO.:	6760-N81	DRILLERS:	JORDAN/GAYLORD	DATE COMPLETED:	1/16/90
PROJECT:	McALLISTER POINT	TRC INSPECTOR:	ZLOTNICK	WATER TABLE LEVEL:	20.4 FT
CLIENT:	U.S.NAVY	DRILLING METHOD:	4-1/4 HOLLOW STEM AUGERS	LOCATION:	
LOCATION:	NEWPORT,RI	GROUND ELEVATION:			
BORING DEPTH:	26.0 FT	CASING ELEVATION:			

DEPTH (FT)	BLOWS	OVA (PPM)	SOIL DESCRIPTION
0 - 2	3 4	25	ORGANIC TOPSOIL, BROWN,(2"); F SAND, SILT, BROWN, DRY,(16");
	10 19		F SAND, SOME ROCK FRAGS, BROWN,(4")
2 - 4	9 21	20	F-M SAND AND SHALE FRAGS, COMPACT, GREY,(20")
	24 5		
4 - 6	7 12	110	FILL, F SAND, LITTLE CLAY, WOODCHIPS, AND WHITE ASH MATERIAL,
	17 14		WOODCHIP IN SPOON TIP,(4")
6 - 8	14 17	100	FILL, F-C SAND, LITTLE CLAY, GREY, SOME WOODCHIPS,(10")
	32 32		
8 - 10	17 28	70	FILL, F-M SAND, LITTLE CLAY AND SHALE FRAGS, TR COBBLES,
	24 18		DK GREY, SOME WOOD PIECES, DAMP,(20")
10 - 12	7 10	120	FILL, F-M SAND, SOME GRAVEL AND SHALE PIECES, DK GREY, LITTLE
	8 10		WOODCHIPS AND CEMENT PIECES, DAMP,(20")
12 - 14	12 35	210	FILL, F-C SAND AND GRAVEL, SOME COBBLES, BLACK, LITTLE ASH
	31 21		MATERIAL, DRY,(16")
14 - 16	13 11	6	FILL, M-C SAND, GRAVEL, AND SHALE FRAGS, GREY, DRY,(18")
	9 9		
16 - 18	8 6		NO RECOVERY
	5 5		
18 - 20	3 9	290	FILL, F-C SAND, BLACK, SOME WOOD PIECES, SATURATED,(20")
	21 16		
20 - 22	13 18	230	FILL, SAME AS 18-20 FT,(18")
	29 25		
22 - 24	100	210	FILL, SAME AS 18-20 FT,(4")
24 - 26	100		NO RECOVERY
26 - 28	100	5	SHALE, DK GREY, FISSILE, DRY,(1")

END OF BORING AT 26.0 FT

(TRC, 1988)

BORING NO.:	MP-MW03D	CONTRACTOR:	COS	OATE STARTEO:	1/18/90
PROJECT NO.:	6760-N81	ORILLERS:	JORDAN/GAYLORD	OATE COMPLETEO:	1/22/90
PROJECT:	McALLISTER POINT	TRC INSPECTOR:	ZLOTNICK/BARRETT	WATER TABLE LEVEL:	22.45 FT
CLIENT:	U.S.NAVY	ORILLING METHOO:	4-1/4 HOLLOW STEM AUGERS	LOCATION:	
LOCATION:	NEWPORT.RI		ANO NO ROCK CORING		
BORING OEPTH:	44.5 FT	GROUNO ELEVATION:			

CASING

OEPTH (FT)	BLOWS	OVA (PPM)	SOIL OESCRIPTION
0 - 2			SEE MONITORING WELL LOG NO. MP-MW03S FOR SOIL OESCRIPTION FROM
2 - 4			0 TO 24 FEET.
24 - 26	100		SHALE. BLACK. FISSILE. ORY.(2")
			STARTEO NO ROCK CORING:
24.5 - 29.5			HIGHLY FRACTUREO DARK GREY TO BLACK SHALE. SOME QUARTZ INCLUSIONS FROM 27.0 TO 27.5 FEET WITH ANTHRACITE. CORE RECOVERY - 46". ROO (0"/46") - 0%
29.5 - 39.5			UPPER 1.7' - BLACK CARBONIFEROUS SHALE. IRON STAINING ON JOINTS ANO FRACTURES. UPPER MIOOLE 2.0' - BLACK ANTHRACITE SHALE TO ANTHRACITE. FISSILE ANO SOFT IN ANTHRACITE ZONES. VERY FRACTUREO. LOWER MIOOLE 1.9'- CONGLOMERATE QUARTZ ARENITE. LARGE 1" COMPACTEO GRAVEL OECREASING IN SIZE WITH OEPTH. GREY. LOWER 3.4' - QUARTZITE. BANOEO. FEW CONGLOMERATIONS WEATHEREO ALONG FRACTURES. LT GREY. CORE RECOVERY - 108". ROO (40"/108") - 37%
39.5 - 44.5			UPPER 0.5' - LT GREY BANOEO QUARTZITE. WEATHEREO ALONG FRACTURES. LOWER 3.3' - OK GREY TO BLACK ANTHRACITE SHALE. FISSILE. SOFT. BREAKS EASILY. MANY FRACTURES ARE MECHANICAL FROM EMPTYING CORE BARREL. CORE RECOVERY - 44". ROO (24"/44") - 55%
			ENO OF BORING AT 44.5 FT

(TRC, 1988)

BORING NO.:	MP-MW05S	CONTRACTOR:	CDS	DATE STARTED:	1/9/90
PROJECT NO.:	6760-NB1	DRILLERS:	JORDAN/GAYLORD	DATE COMPLETED:	1/9/90
PROJECT:	McALLISTER POINT	TRC INSPECTOR:	ZLOTNICK/BARRETT	WATER TABLE LEVEL:	8.5 FT
CLIENT:	U.S.NAVY	DRILLING METHOD:	4-1/4" HOLLOW STEM AUGERS	LOCATION:	
LOCATION:	NEWPORT,RI	GROUND ELEVATION:			
BORING DEPTH:	17 FT	CASING ELEVATION:			

DEPTH (FT)	BLOWS	OVA (PPM)	SOIL DESCRIPTION
0 - 2	5 7 17 17	4.8	CLAY, SOME SILT, LITTLE F-M SAND, BROWN, WET,(4"): FILL, CLAY, LITTLE SILT AND M GRAVEL, GREY, MOIST,(4")
2 - 4	7 17 14 18	700	FILL, CLAY AND SILT, SOME F GRAVEL (GREY SHALE FRAGS),STIFF, DRY,(15")
4 - 6	10 18 10 7	>1000	FILL, CLAY AND SILT, LITTLE F-M GRAVEL, BLACK, STIFF, ROOF SHINGLE AND WOOD DEBRIS, MOIST,(15")
6 - 8	5 4 12 14	>1000	FILL, SAME AS 4-6 FEET, SOME M-C SAND VS. F-M GRAVEL, SATURATED, (5")
8 - 10	4 10 8 9	700	FILL, SAME AS 6-8 FEET, SATURATED, (2")
10 - 12	6 15 18 18	>1000	FILL, SAME AS 8-10 FEET,(5"); F-M SAND, LITTLE CLAY, TR SILT, GREY, SATURATED,(6"); M-C SAND, SILT AND CLAY, BROWN, SATURATED
12 - 14	16 22 22 17		F-M SAND, TR CLAY AND SILT, GREY, DAMP,(5"); TILL, MOSTLY CLAY AND SILT, GREY TO ORANGE BROWN, SATURATED,(11")
15 - 17	15 18 20 19	5.2	TILL, SAME AS 12-14 FEET,(5")

END OF BORING AT 17 FT

NOTES: SHELBY TUBE PUSHED FROM 14 FEET TO 15.5 FEET. SHELBY TUBE IS MARKED TOP AND BOTTOM. TOTAL RECOVERED INSITU SAMPLE IS FROM THE BOTTOM TO 14.5". FROM 14.5" TO TOP OF SHELBY TUBE FILLED WITH NO. 1 MORREY SAND. SEALED ENDS WITH PLASTIC CAPS AND WAX. (TOTAL LENGTH OF SHELBY TUBE IS 30")

(TRC, 1988)

BORING NO.:	MP-MW05D	CONTRACTOR:	CDS	DATE STARTED:	1/17/90
PROJECT NO.:	6760-NB1	DRILLERS:	JORDAN/GAYLORD	DATE COMPLETED:	1/18/90
PROJECT:	McALLISTER POINT	TRC INSPECTOR:	ZLOTNICK/BARRETT	WATER TABLE LEVEL:	15.9 FT
CLIENT:	U.S.NAVY	DRILLING METHOD:	4-1/4" HOLLOW STEM AUGERS	LOCATION:	
LOCATION:	NEWPORT,RI	GROUND ELEVATION:			
BORING DEPTH:	48 FT	CASING ELEVATION:			

DEPTH (FT)	BLOWS	OVA (PPM)	SOIL DESCRIPTION
0 - 2			SEE MONITORING WELL LOG NO. MP-MW05S FOR SOIL DESCRIPTION FROM
2 - 4			0 TO 17 FEET.
17 - 19	7 5 11 14		F SAND AND CLAY. SOME SHALE FRAGS. LT BROWN.(14")
19 - 21	7 11 12 13		SILT. CLAY AND SHALE FRAGS. LT BROWN. WET.(20")
21 - 23	7 20 36 42		SAME AS 19-21 FT.(12"); WEATHERED SHALE.LT BROWN.(10")
23 - 25	96 100		WEATHERED SHALE. LT BROWN.(6"); WEATHERED SHALE. DK BROWN.(5")
24 - 26	33 100		WEATHERED SHALE. BROWN.(10")
26 - 28	38 100		WEATHERED SHALE. BROWN W/IRON STAINING.(5")
28 - 30	70 100		WEATHERED SHALE. GRAYISH-BROWN.(11")
30 - 32	82 100		WEATHERED SHALE. LT BLUE TO GREY. SOME IRON OXIDE VEINS.(7")
32 - 34	100		NO RECOVERY
35 - 37	100 100		WEATHERED SHALE. GRAINY. BLUE TO GREY.SOME QTZ/CALCITE VEINS. CLAYEY WHEN WET.(5")
38 - 40	100		WEATHERED SHALE. BLUE TO GREY. SOME QUARTZITE XTALLATION. CLAYEY WHEN WET.(4")
43 - 45	100		NO RECOVERY
48 - 50	100		NO RECOVERY

(TRC, 1988)

BORING NO.:	MP-MW04S	CONTRACTOR:	CDS	DATE STARTED:	1/9/90
PROJECT NO.:	6760-N81	DRILLERS:	JORDAN/GAYLORD	DATE COMPLETED:	1/10/90
PROJECT:	McALLISTER POINT	TRC INSPECTOR:	ZLOTNICK	WATER TABLE LEVEL:	7.3 FT
CLIENT:	U.S.NAVY	DRILLING METHOD:	4-1/4" HOLLOW STEM AUGERS	LOCATION:	
LOCATION:	NEWPORT,RI	GROUND ELEVATION:			
BORING DEPTH:	12 FT	CASING ELEVATION:			

DEPTH (FT)	BLOWS	OVA (PPM)	SOIL DESCRIPTION
0 - 2	3 2	3	FILL. F SAND AND SILT. DK BROWN. SOME GREEN PLASTIC PIECES.(6")
	5 4		
2 - 4	2 8		NO RECOVERY
	11 9		
4 - 6	4 4	9	FILL. F SAND. DK BROWN. SOME PLASTIC PIECES. WET.(4")
	3 3		
6 - 8	2 1	400	FILL. F SAND. DK BROWN. LITTLE ORANGE RUBBER STRIPS. WET.(5");
	1 3		F-M SAND. LITTLE GRAVEL AND WEATHERED SHALE PIECES. GREY.(5")
8 - 10	7 12	30	WEATHERED SHALE. GREY.(24")
	16 24		
10 - 12	10 29	8	WEATHERED SHALE. GREY.(20")
	40 52		

END OF BORING AT 12 FT

(TRC, 1988)

BORING NO.:	MP-MW06S	CONTRACTOR:	CDS	DATE STARTED:	6/19/90
PROJECT NO.:	6760-N81	DRILLERS:	DENNIS/JEFF	DATE COMPLETED:	6/19/90
PROJECT:	McALLISTER POINT	TRC INSPECTOR:	SMITH	WATER TABLE LEVEL:	7.8 FT
CLIENT:	U.S.NAVY	DRILLING METHOD:	4-1/4" HOLLOW STEM AUGERS	LOCATION:	
LOCATION:	NEWPORT,RI	GROUND ELEVATION:			
BORING DEPTH:	14 FT	CASING ELEVATION:			

DEPTH (FT)	BLOWS	HNu (PPM)	SOIL DESCRIPTION
0 - 2	6 36	1	SILT, BROWN, (14"), DARK BROWN LAYER AT 12"
	37 33		FINE SAND, SOME SILT, TAN, (4")
2 - 4	16 10	1.5	SILT, LITTLE SAND, TRACE GRAVEL, BROWN (6")
	11 15		
4 - 6	9 6	--	NO RECOVERY
	5 6		
6 - 8	6 4	--	NO RECOVERY, SPOON WAS WET
	17 1		
8 - 10	3 3	1.2	SILT, LITTLE SAND AND WOOD, BROWN, WET, SLIGHT ODOR
	11 16		
10 - 12	3 6	1	SILT, SOME F. SAND, LITTLE DEBRIS (16")
	14 19		SILT AND WEATHERED SHALE, BROWN, WET, SLIGHT ODOR (8")
12 - 14	19 21	1	SILT AND WEATHERED SHALE, TAN (24")
	21 31		

END OF BORING - 14 FT.

(TRC, 1988)

BORING NO.:	MP-MW07S	CONTRACTOR:	CDS	DATE STARTED:	6/19/90
PROJECT NO.:	6760-N81	DRILLERS:	DENNIS/JEFF	DATE COMPLETED:	6/20/90
PROJECT:	McALLISTER POINT	TRC INSPECTOR:	SMITH	WATER TABLE LEVEL:	14.6 FT
CLIENT:	U.S.NAVY	DRILLING METHOD:	4-1/4" HOLLOW STEM AUGERS	LOCATION:	
LOCATION:	NEWPORT,RI	GROUND ELEVATION:			
BORING DEPTH:	30 FT	CASING ELEVATION:			

DEPTH (FT)	BLOWS	HNu (PPM)	SOIL DESCRIPTION
0 - 2	4 4	2.2	FINE SAND. SOME SILT. TRACE SHALE. BROWN (18")
	3 3		FINE SAND. TAN (4")
2 - 4	4 3	1.2	FINE SAND. TAN (6") WOOD AND DEBRIS (4")
	4 12		ORGANICS. POSS. CHARCHOL AND SAND. BLACK. SLIGHT ODOR (4")
4 - 6	6 9	1.2	WEATHERED SHALE AND SILT. GRAY (12")
	9 8		FINE SAND. TAN (2")
6 - 8	18 31	1.2	WEATHERED SHALE TO COMPETENT SHALE. GRAY (24")
	43 68		
8 - 10	24 56	1.8	WEATHERED SHALE TO COMPETENT SHALE. GRAY (18")
	100/6"		
10 - 12	36 100/	1	SAME AS ABOVE (8")
	5"		
12 - 14	100/6"	1.2	SAME AS ABOVE (4")
			AUGERED TO BEDROCK
20			
30			
			END OF BORING - 30 FT.

APPENDIX G

Landfill Stratigraphy at Monitoring Well Locations

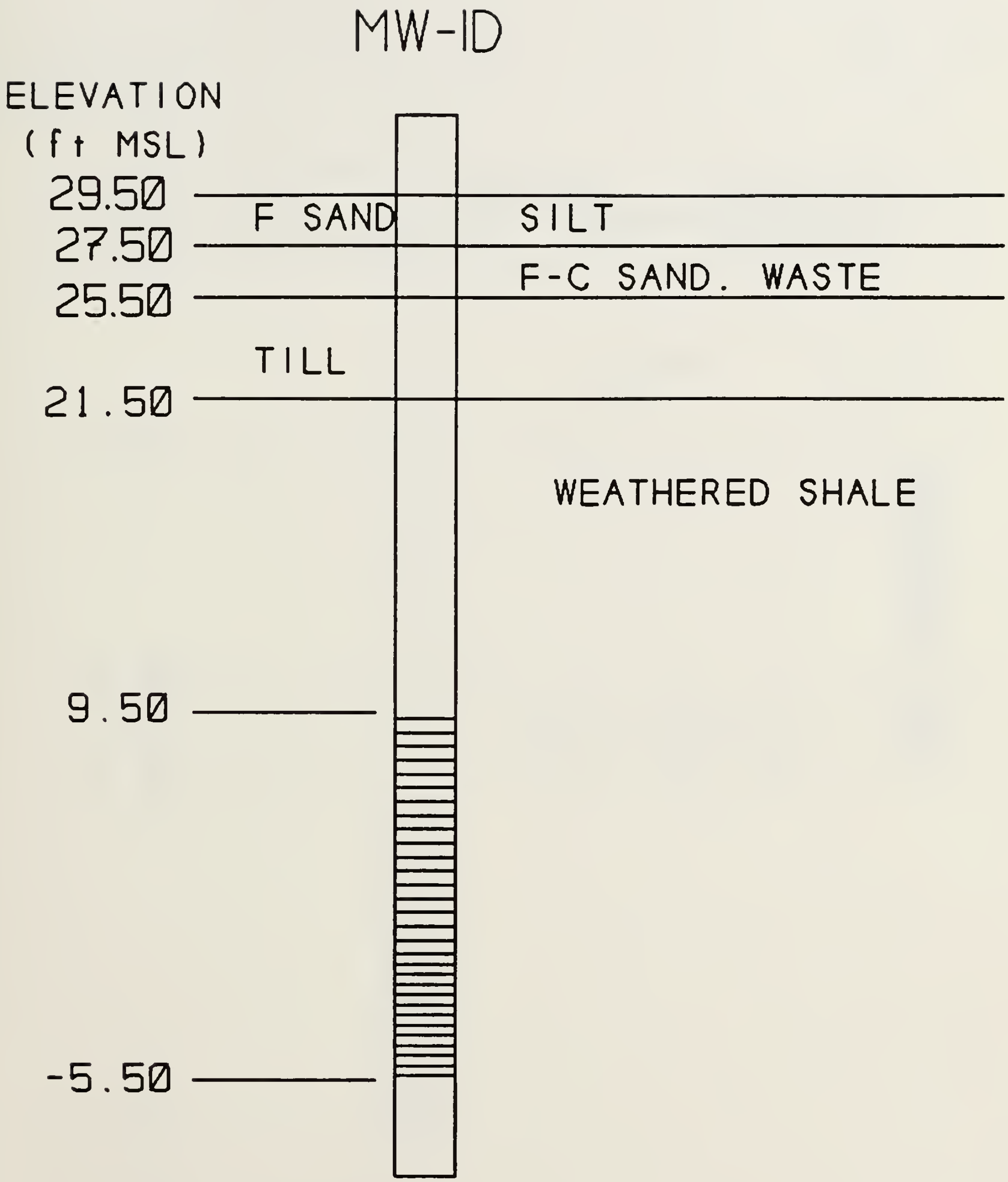

Figure 33. Stratigraphy and Well Screen Depth for MW-1D

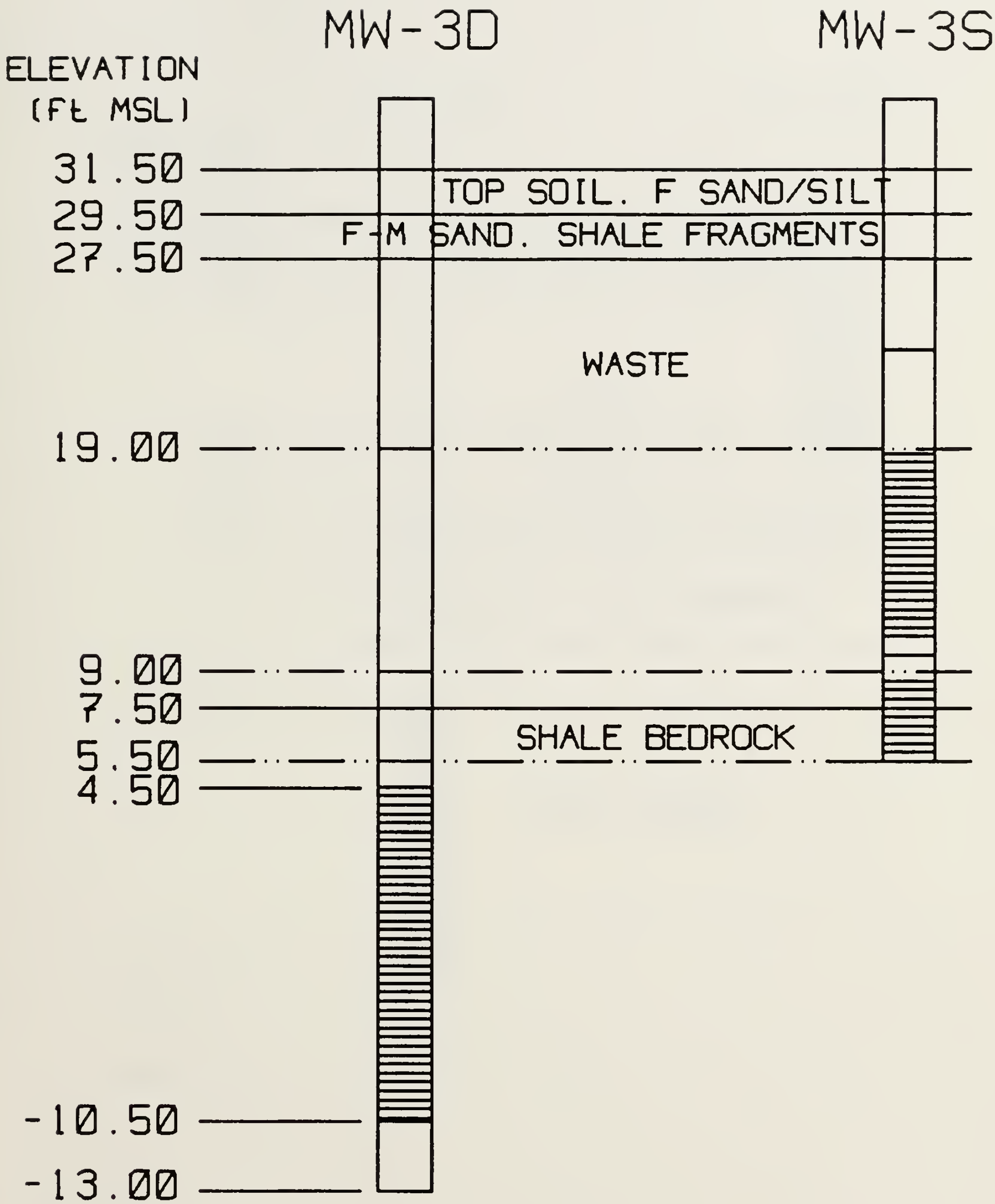

Figure 34. Stratigraphy and Well Screen Depth for MW-3D/S

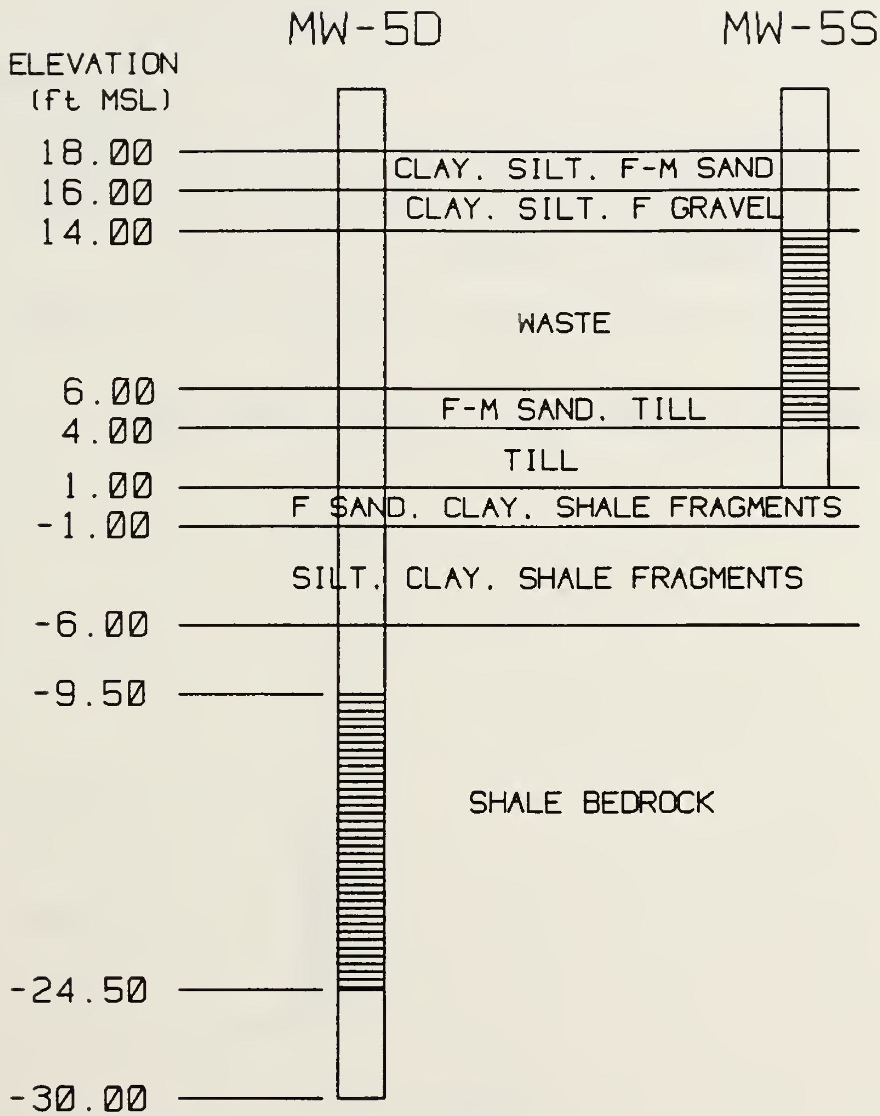

Figure 35. Stratigraphy and Well Screen Depth for MW-5D/S

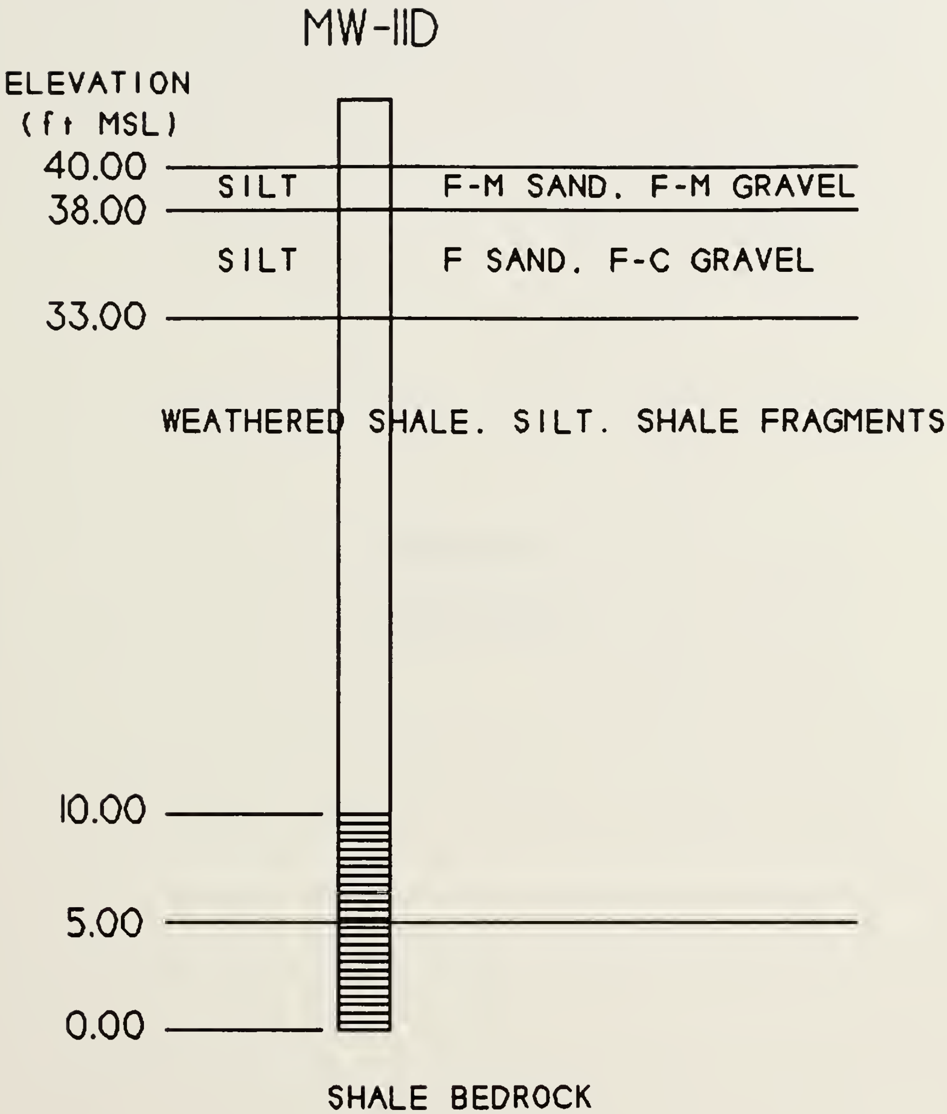

Figure 36. Stratigraphy and Well Screen Depth for MW-11D

APPENDIX H

Survey Data

McAllister Point Landfill
Location Data for Soil Samples
Monitoring Wells
Soil Borings
Leachate Spring

Gathered: 07/13/90
Firm: Septakowshi & Assoc.
Crew: Nehring
Alyward

BS	OCC	FS	H ANGLE	H DIST	DESCRIPTION
12+00 450L	12+00 150L	150L.1	312.51	608.21	MW-11
		.2	349.90	381.36	SS 6
		.3	5.54	389.47	SS 7
		.4	4.92	274.43	B 7
		.5	7.53	145.70	B 6
		.6	78.07	125.25	MW-21
		.7	45.23	96.14	V 11
		.8	235.58	167.72	YF NO #
		.9	253.08	215.70	B 4
		.10	291.35	141.72	B 5
		.11	310.92	120.42	MW-3D
		.12	313.38	120.30	MW-3S
		.13	316.21	301.64	SS 5
		.14	315.07	299.74	MW-4
		.15	284.66	358.37	SS 4
12+45.84	13+50 700L	700L.1	273.55	105.24	SS 8
		.2	8.69	47.28	MW-6S
		.3	30.61	76.98	SS 9
		.4	179.90	74.81	B 9
		.5	111.89	113.27	B 8
		.6	117.45	225.29	SS 10
		.7	131.38	213.86	MW-5S
		.8	132.48	213.97	MW-5D
		.9	125.53	268.29	B 10
		.10	124.11	326.01	SS 11
		.11	257.68	278.07	MW-10
6+00 50L	6+00 50R	50R.1	6.26	171.26	SS 3
		.2	44.89	85.62	B 2
		.3	106.05	12.79	MW-2
		.4	332.46	162.85	MW-7S
		.5	273.05	279.86	B 1
		.6	273.29	382.13	SS 2
		.7	274.44	437.62	MW-1
12+00 500L	13+98.11 500L	500L.1	116.84	324.47	SS 12
		.2	113.23	227.36	SS 13
		.3	123.49	82.06	SS 14
		.4	260.25	302.78	LEACHATE SPRING
12+00 250L	12+00 61.66	61.66L.1	134.23	49.14	SS 15

APPENDIX I

Tidal Stress - Well Response Curves

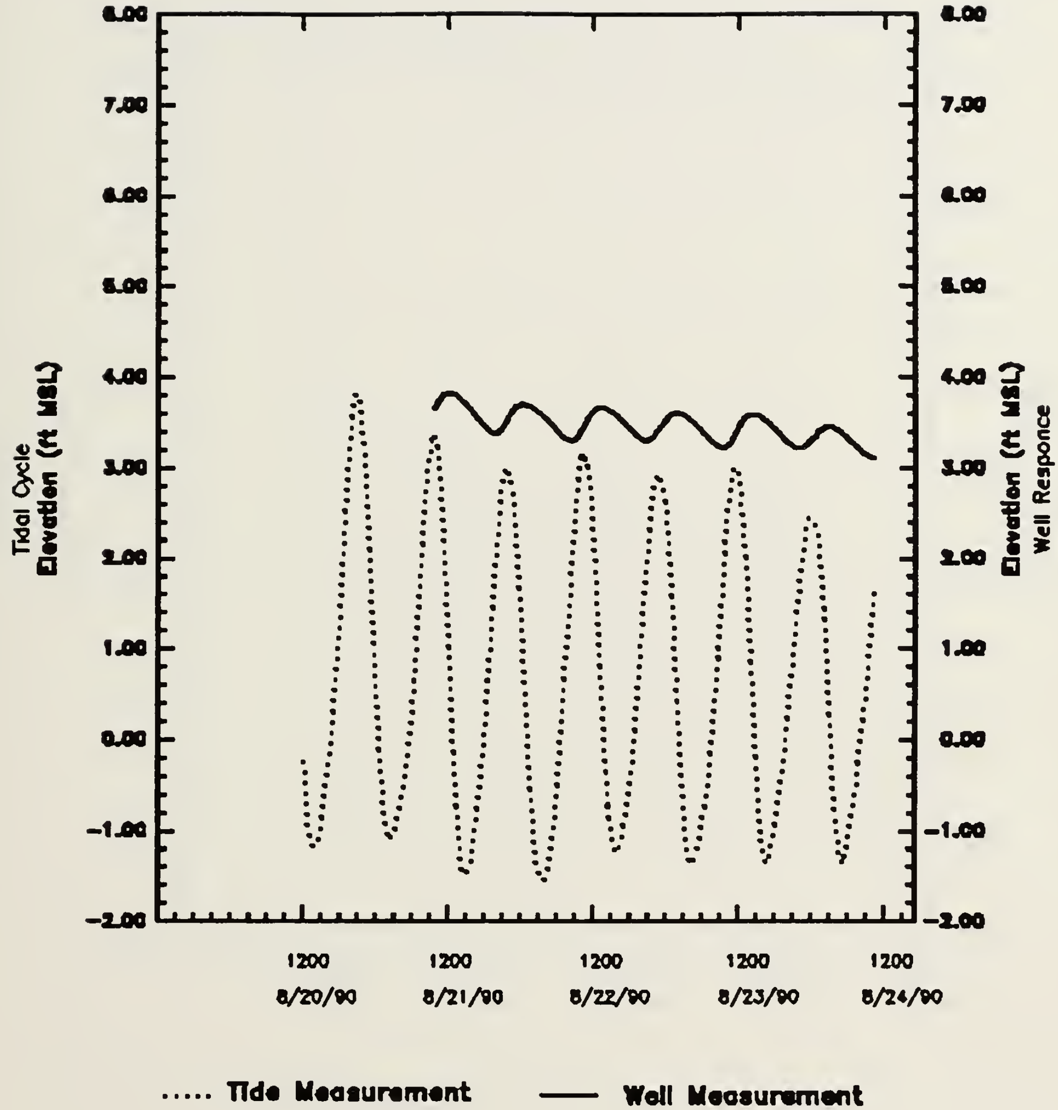

Figure 37. Tidal Stress on Monitoring Well 1D

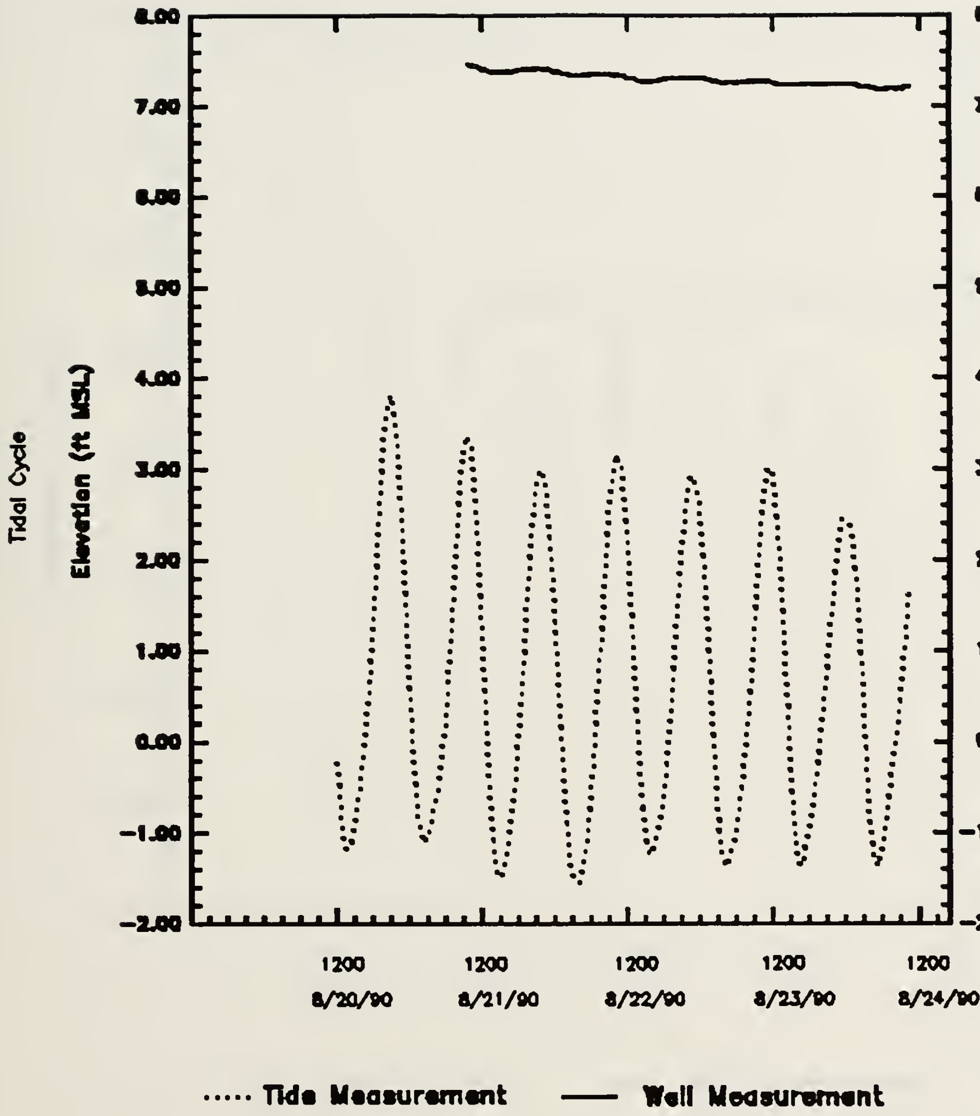

Figure 38. Tidal Stress on Monitoring Well 3D

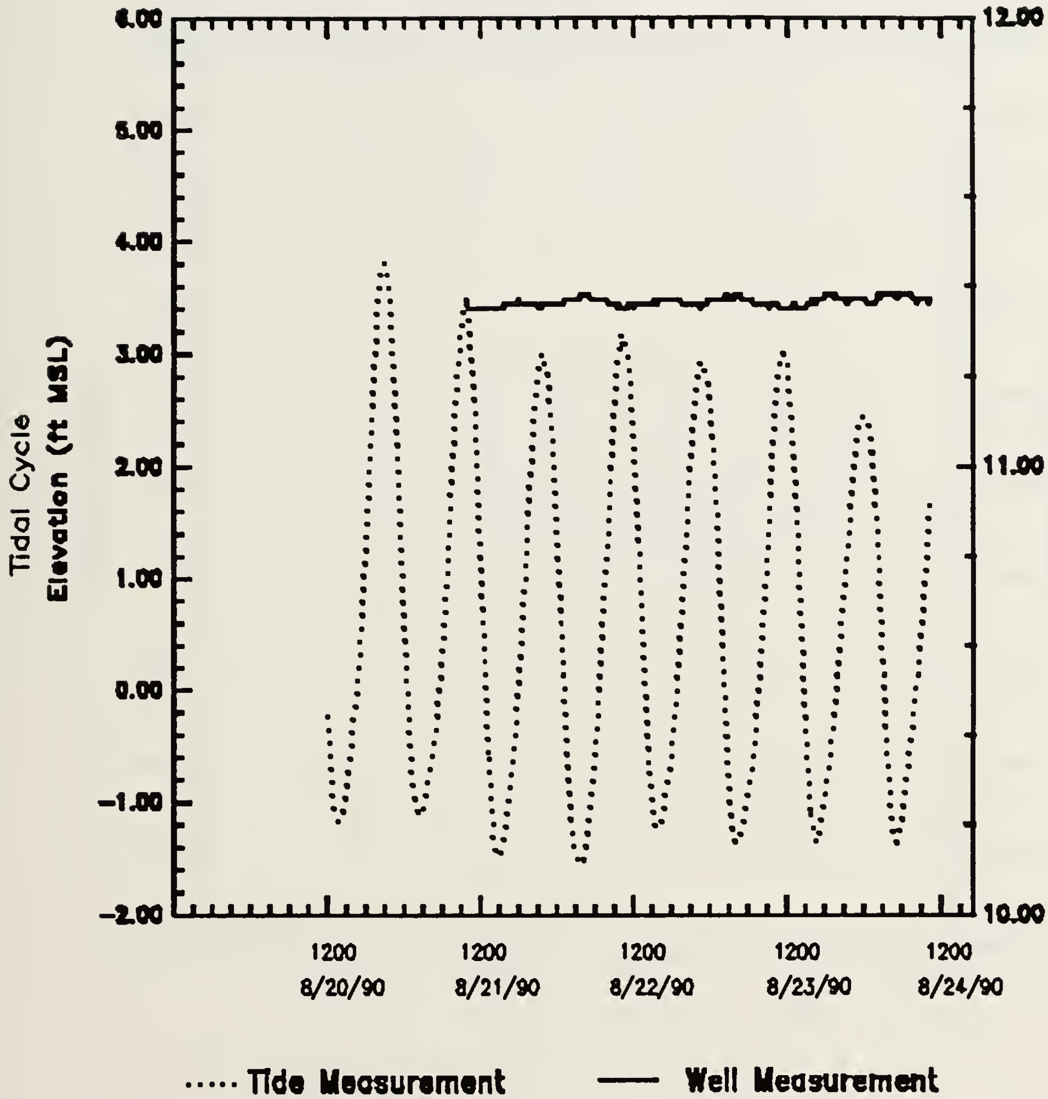

Figure 39. Tidal Stress on Monitoring Well 3S

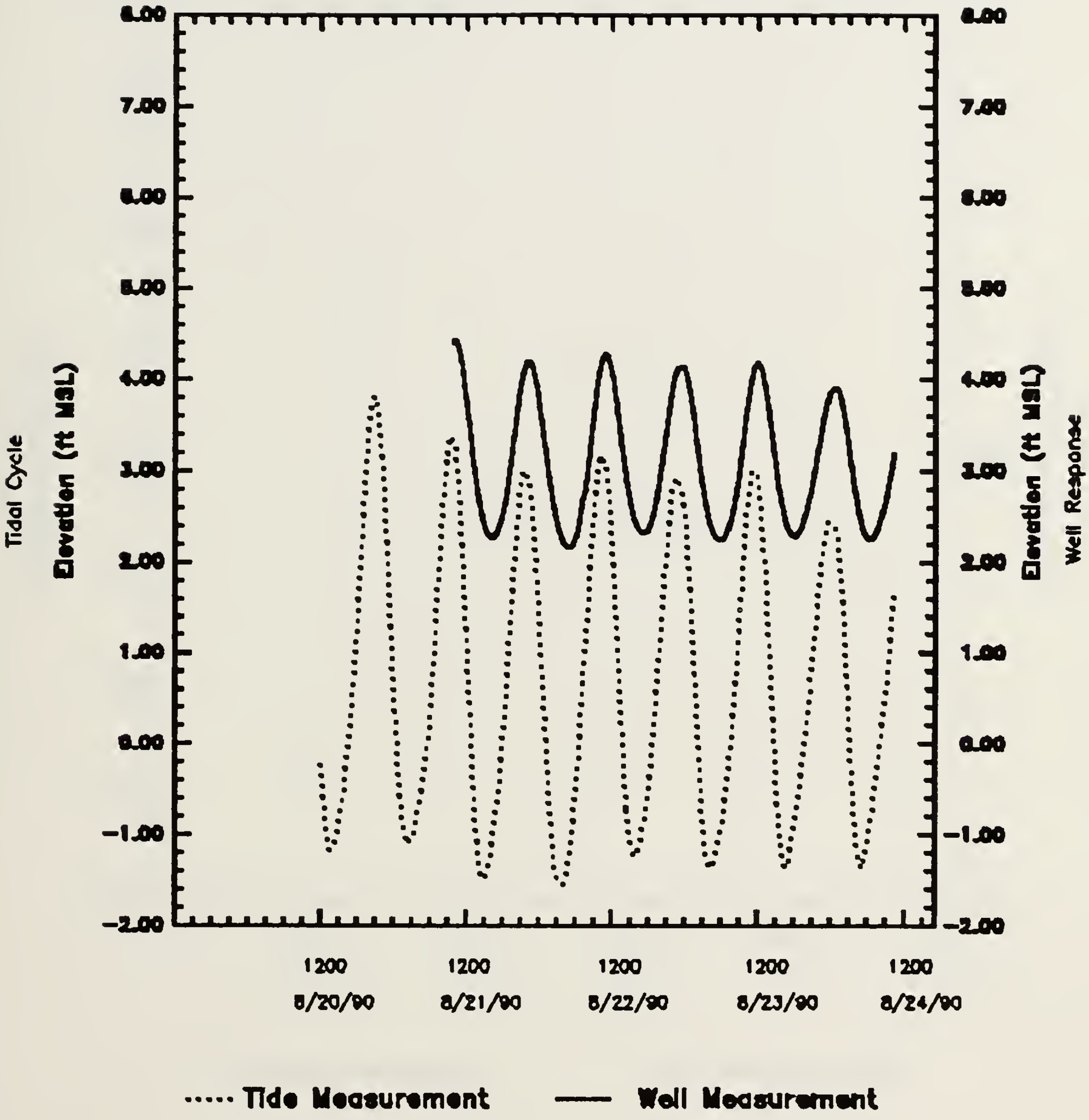

Figure 40. Tidal Stress on Monitoring Well 5D

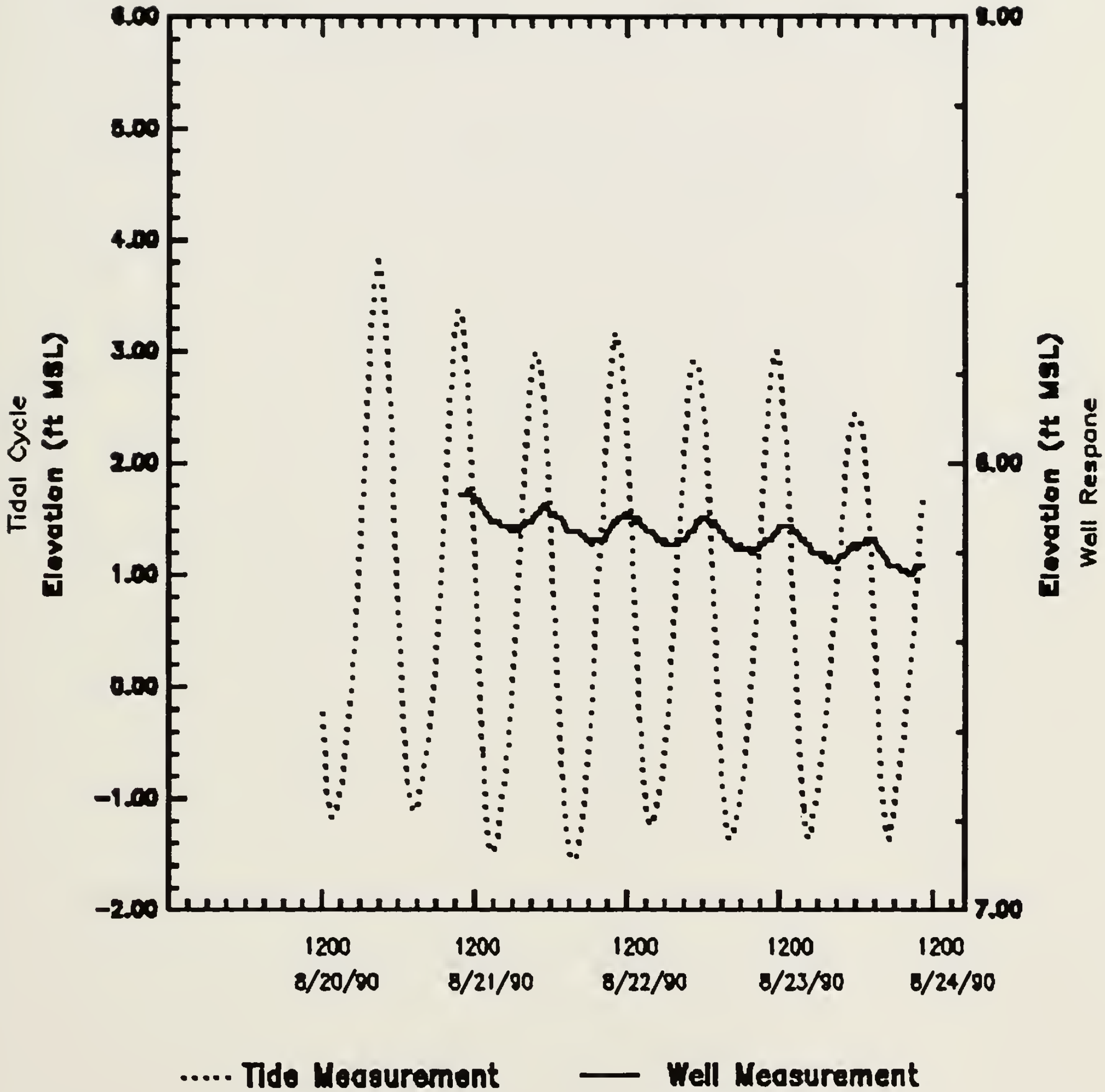

Figure 41. Tidal Stress on Monitoring Well 5S

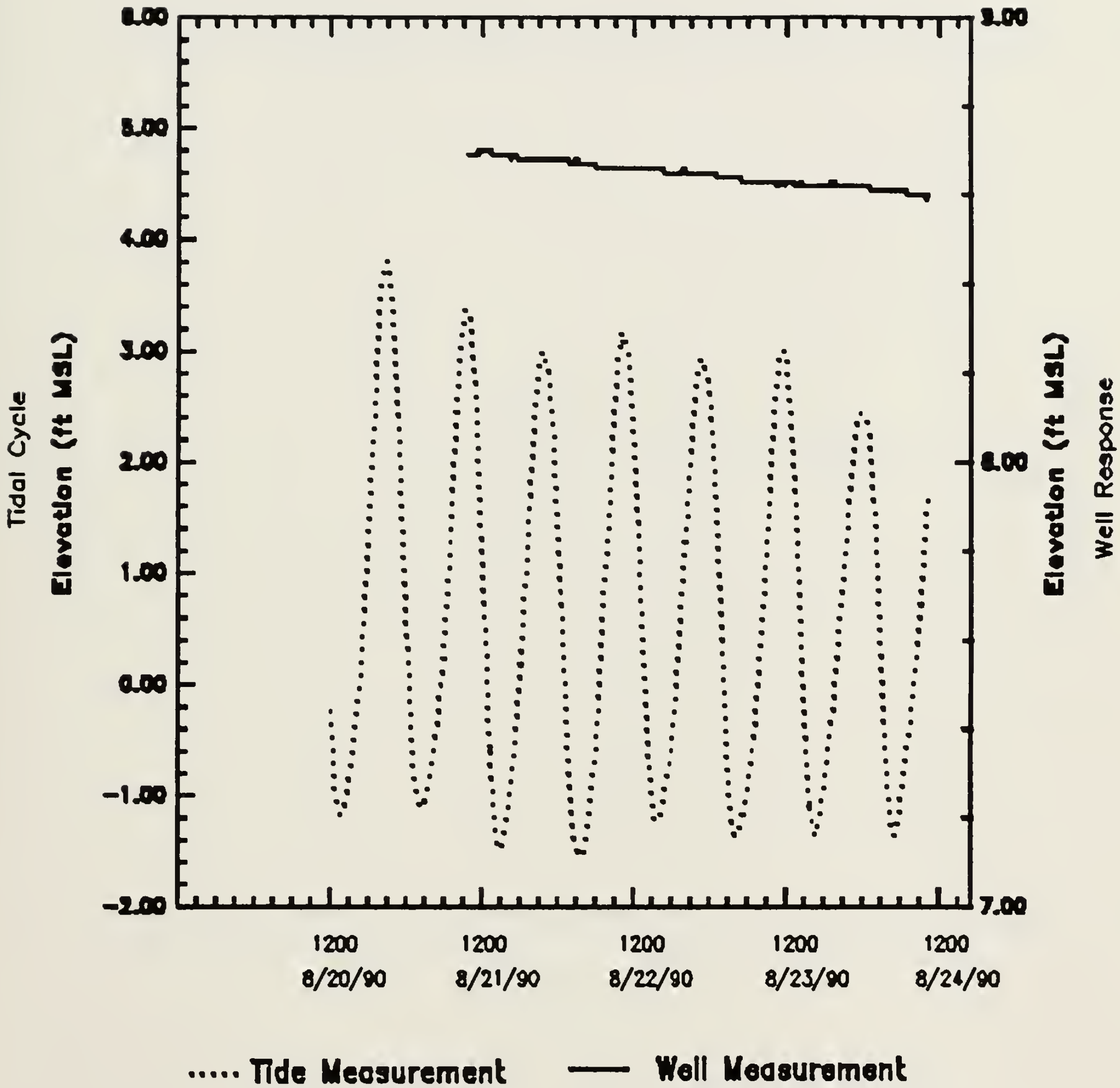

Figure 42. Tidal Stress on Monitoring Well 6S

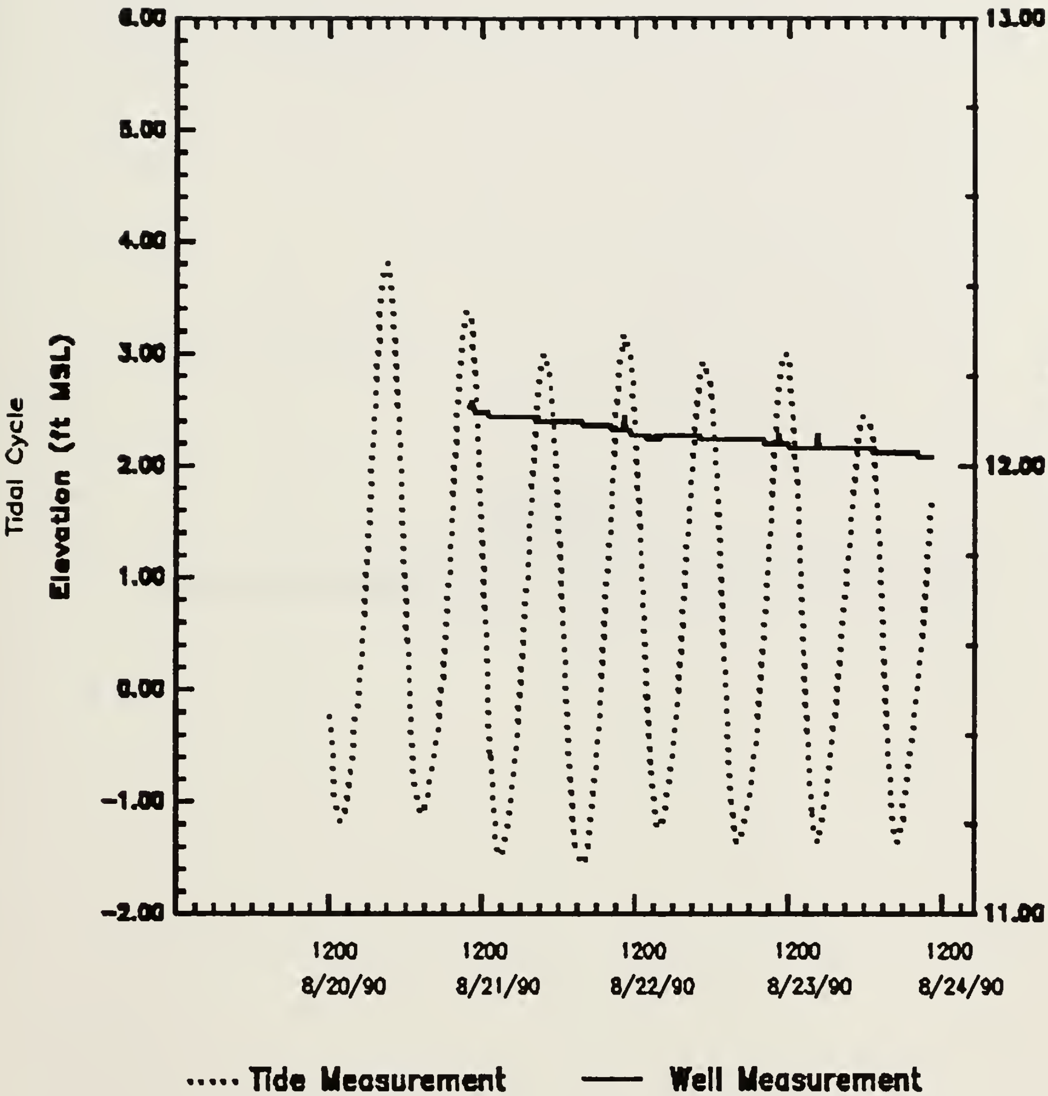

Figure 43. Tidal Stress on Monitoring Well 7S

APPENDIX J

Precipitation Graphs 1987-1990 Lawton Valley Reservoir

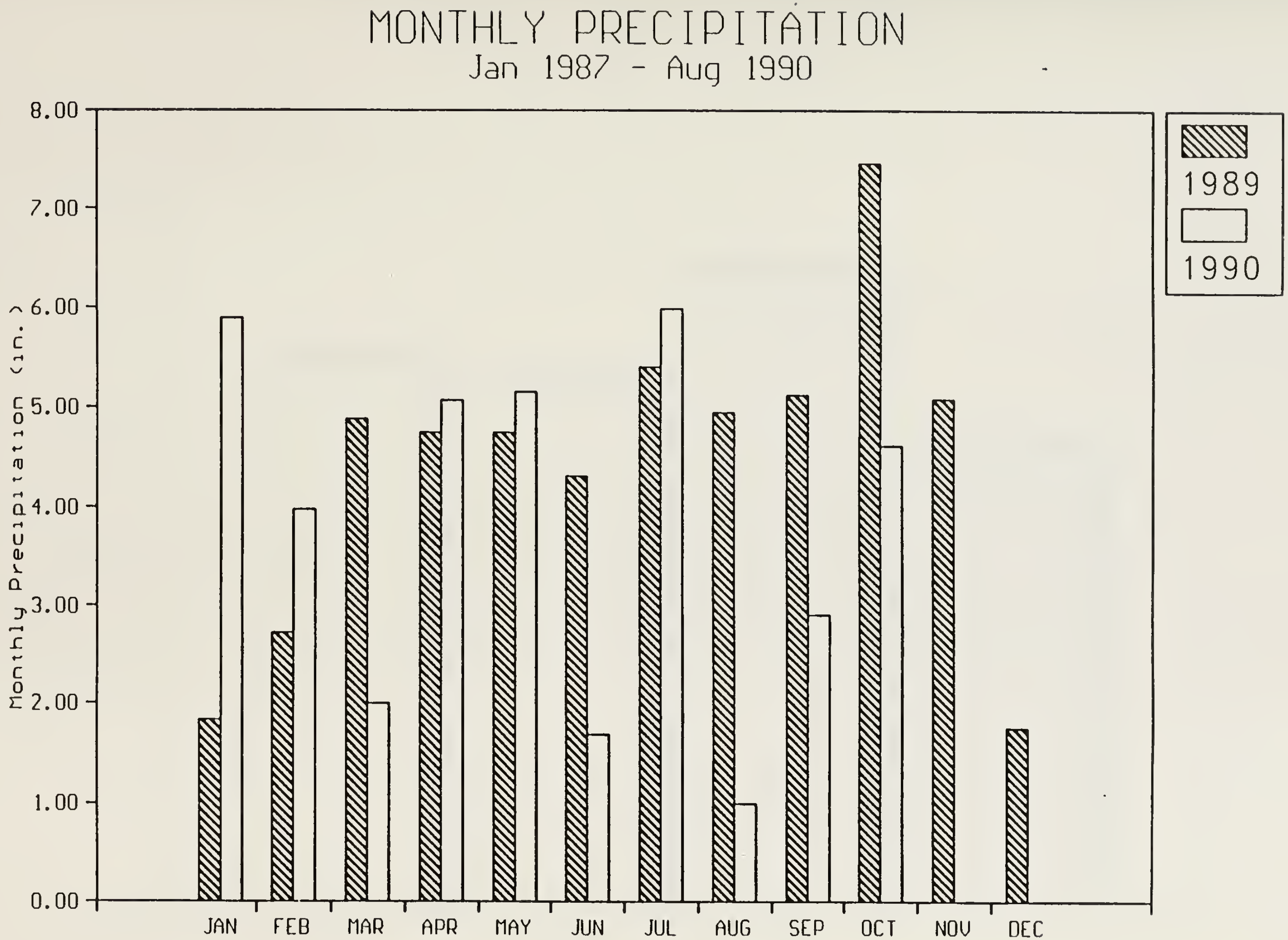

Figure 44. Monthly Precipitation for 1987 - 1990 in the Newport Area

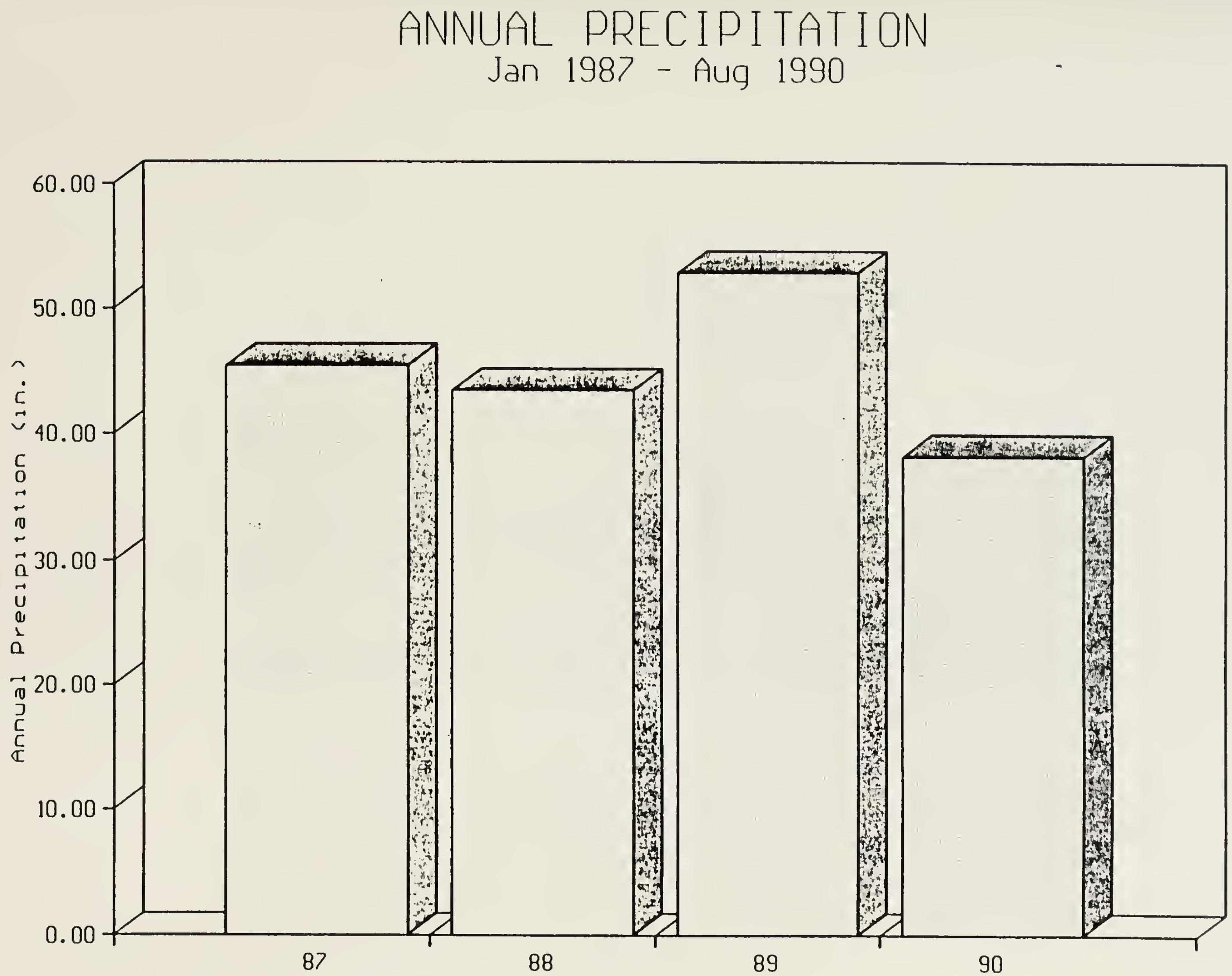

Figure 45. Annual Precipitation for 1987 -1990 in Newport, RI

APPENDIX K

Time-lag Permeability Data and Results

MCALLISTER POINT PERMEABILITY TESTS

WELL NUMBER: MW-1D
STANDPIPE RADIUS (INCHES) = 1
INTAKE RADIUS (INCHES) = 3
LENGTH OF INTAKE (FEET) = 15
DEPTH TO TOP OF INTAKE (FEET) = 20
DEPTH TO STATIC WATER LEVEL (FEET) = 25.32
DEPTH TO PURGE WATER LEVEL (FEET) = 27.93

TIME (SECONDS)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	H/HO
4.98	27.93	2.61	1
10.02	27.37	2.05	.7854412
19.98	26.8	1.48	.5670498
35.4	26.44	1.12	.429119
40.02	26.13	0.81	.3103443
49.98	25.91	0.59	.2260535
60	25.75	0.43	.1647508
75	25.58	0.26	9.961674E-02
90	25.46	0.14	5.363942E-02
105	25.37	0.05	1.915732E-02

UNCONFINED AQUIFER

K = 0.1E-02 cm/sec
= 22.5 gpd/ft2
= 0.3E-04 ft/sec
= 3.0 ft/day

REGRESSION COEFFICIENT = -.9900954

MCALLISTER POINT PERMEABILITY TESTS

WELL NUMBER: MW-3D
STANDPIPE RADIUS (INCHES) = 1
INTAKE RADIUS (INCHES) = 3
LENGTH OF INTAKE (FEET) = 15
DEPTH TO TOP OF INTAKE (FEET) = 27
DEPTH TO STATIC WATER LEVEL (FEET) = 22.59
DEPTH TO PURGE WATER LEVEL (FEET) = 25.59

TIME (SECONDS)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	H/HO
10.02	24.99	2.40	.7999996
19.98	24.29	1.70	.5666665
30	23.92	1.33	.4433334
40.02	23.69	1.10	.3666666
49.98	23.55	0.96	.3199997
60	23.45	0.86	.2866665
75	23.35	0.76	.2533333
90	23.27	0.68	.2266666

UNCONFINED AQUIFER

K = 0.4E-03 cm/sec
= 9.2 gpd/ft2
= 0.1E-04 ft/sec
= 1.2 ft/day

REGRESSION COEFFICIENT = -.95834

MCALLISTER POINT PERMEABILITY TESTS

WELL NUMBER: MW-5D
STANDPIPE RADIUS (INCHES) = 1
INTAKE RADIUS (INCHES) = 3
LENGTH OF INTAKE (FEET) = 15
DEPTH TO TOP OF INTAKE (FEET) = 27.5
DEPTH TO STATIC WATER LEVEL (FEET) = 15.64
DEPTH TO PURGE WATER LEVEL (FEET) = 17.7

TIME (SECONDS)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	H/HO
4.98	17.7	2.06	1
10.02	17.43	1.79	.8689315
19.98	17.08	1.44	.6990288
30	16.81	1.17	.5679603
40.02	16.58	0.94	.4563104
49.98	16.42	0.78	.3786404
60	16.27	0.63	.3058248
75	16.13	0.49	.2378634
90	16.04	0.40	.1941749
105	15.96	0.32	.1553391
120	15.9	0.26	.1262135

UNCONFINED AQUIFER

K = 0.5E-03 cm/sec
= 11.0 gpd/ft2
= 0.2E-04 ft/sec
= 1.5 ft/day

REGRESSION COEFFICIENT = -.9953194

MCALLISTER POINT PERMEABILITY TESTS

WELL NUMBER: MW-10D
STANDPIPE RADIUS (INCHES) = 1
INTAKE RADIUS (INCHES) = 3
LENGTH OF INTAKE (FEET) = 10
DEPTH TO TOP OF INTAKE (FEET) = 17
DEPTH TO STATIC WATER LEVEL (FEET) = 13.94
DEPTH TO PURGE WATER LEVEL (FEET) = 16.09

TIME (SECONDS)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	H/HO
4.98	16.09	2.15	1
10.02	15.32	1.38	.6418607
19.98	14.63	0.69	.3209307
30	14.28	0.34	.1581395
40.02	14.13	0.19	.0883726
49.98	14.03	0.09	.0418604
60	13.99	0.05	.0232561
75	13.96	0.02	9.302877E-03

UNCONFINED AQUIFER

K = 0.3E-02 cm/sec
= 55.0 gpd/ft2
= 0.9E-04 ft/sec
= 7.4 ft/day

REGRESSION COEFFICIENT = -.9991796

MCALLISTER POINT PERMEABILITY TESTS

WELL NUMBER: MW-11D
STANDPIPE RADIUS (INCHES) = 1
INTAKE RADIUS (INCHES) = 3
LENGTH OF INTAKE (FEET) = 10
DEPTH TO TOP OF INTAKE (FEET) = 30
DEPTH TO STATIC WATER LEVEL (FEET) = 14.89
DEPTH TO PURGE WATER LEVEL (FEET) = 19.41

TIME (SECONDS)	WATER LEVEL (FEET)	DRAWDOWN (FEET)	H/HO
4.98	19.41	4.52	1
10.02	18.56	3.67	.8119466
19.98	18	3.11	.6880531
30	17.61	2.72	.6017698
40.02	17.24	2.35	.5199115
49.98	16.93	2.04	.4513273
60	16.65	1.76	.3893802
75	16.33	1.44	.318584
90	16.07	1.18	.2610619
105	15.88	0.99	.2190266
120	15.73	0.84	.1858404
150	15.52	0.63	.1393807
180	15.38	0.49	.1084071

UNCONFINED AQUIFER

K = 0.5E-03 cm/sec
  = 10.4 gpd/ft2
  = 0.2E-04 ft/sec
  = 1.4 ft/day

REGRESSION COEFFICIENT = -.9917762

APPENDIX L

Seepage Flux Calculations Summaries

Sloping Beach Calculations
MW-5S

Q' =	4.75E-05 cfs/ft	Yt =	4.06 ft	Yx =	0.08 ft
df =	1.000	Ym =	2.03 ft	S =	0.2
ds =	1.025	Wf =	81 ft	to =	6.5 hr
ds-df =	0.025	Wm =	41 ft	b =	8 ft
s =	0.05 ft/ft	Wo =	0.03 ft		
Ls =	2000 ft	Q =	0.095 cfs		

Effective Hydraulic Conductivity

K = 3.13E-02

Pivot Point Calculation

Xp = 379.22 ft

Yp = 0.0300 ft

dY = 0.508

dX = 10.150

TIME STEP	I	W	Q	q	tf	qf
0	0.0001	0.03	4.75E-05	1.56E-03	0.00	0.00E+00
1	0.0014	0.53	8.29E-04	1.56E-03	0.16	2.50E-04
2	0.0026	1.00	1.57E-03	1.56E-03	0.17	2.66E-04
3	0.0038	1.45	2.28E-03	1.56E-03	0.20	3.13E-04
4	0.0049	1.88	2.95E-03	1.56E-03	0.47	7.36E-04
					Total q	1.56E-03

Check q * Wo = Q'

4.75E-05 4.75E-05

Percent error 0.00%

Sloping Beach Calculations

MW-5S Low Recharge Conditions

Q' =	1.90E-05 cfs/ft	Yt =	4.06 ft	Yx =	0.08 ft
df =	1.000	Ym =	2.03 ft	S =	0.2
ds =	1.025	Wf =	81 ft	to =	6.5 hr
ds-df =	0.025	Wm =	41 ft	b =	8 ft
s =	0.05 ft/ft	Wo =	0.01 ft		
Ls =	2000 ft	Q =	0.038 cfs		

Effective Hydraulic Conductivity

K = 3.13E-02

Pivot Point Calculation

Xp = 379.22 ft

Yp = 0.0190 ft

dY = 0.508

dX = 10.150

TIME STEP	I	W	Q	q	tf	qf
0	0.0001	0.01	1.90E-05	1.56E-03	0.00	0.00E+00
1	0.0014	0.33	5.13E-04	1.56E-03	0.16	2.50E-04
2	0.0026	0.63	9.83E-04	1.56E-03	0.17	2.66E-04
3	0.0038	0.91	1.43E-03	1.56E-03	0.20	3.13E-04
4	0.0049	1.18	1.85E-03	1.56E-03	0.47	7.36E-04
					Total q	1.56E-03

Check q * Wo = Q'

1.9E-05 1.9E-05

Percent error 0.00%

Sloping Beach Calculations

MW-5S High Recharge Conditions

Q' =	9.50E-05 cfs/ft	Yt =	4.06 ft	Yx =	0.08 ft
df =	1.000	Ym =	2.03 ft	S =	0.2
ds =	1.025	Wf =	81 ft	to =	6.5 hr
ds-df =	0.025	Wm =	41 ft	b =	8 ft
s =	0.05 ft/ft	Wo =	0.06 ft		
Ls =	2000 ft	Q =	0.19 cfs		

Effective Hydraulic Conductivity

K = 3.13E-02

Pivot Point Calculation

Xp = 379.22 ft

Yp = 0.0424 ft

dY = 0.508

dX = 10.150

TIME STEP	I	W	Q	q	tf	qf
0	0.0001	0.06	9.50E-05	1.56E-03	0.00	0.00E+00
1	0.0014	0.77	1.20E-03	1.56E-03	0.16	2.50E-04
2	0.0026	1.44	2.25E-03	1.56E-03	0.17	2.66E-04
3	0.0038	2.07	3.24E-03	1.56E-03	0.20	3.13E-04
4	0.0049	2.68	4.19E-03	1.56E-03	0.47	7.36E-04
					Total q	1.56E-03

Check q * Wo = Q'

9.5E-05 9.5E-05

Percent error 0.00%

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Thesis
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